AUGUST, 1956

Traffic Engineering

- Improving Seeing Efficiency with Roadway Lighting
- One Year of Traffic Engineering in Arkansas
- Planning of Access Controlled Highways in the San Diego Area
- Dallas - Fort Worth Turnpike Toll Collections

Six-year record shows Alcoa® Aluminum doubles sign life in Charlotte, N. C.

HERMAN HOOSE, Traffic Engineer, Charlotte, N. C.

In Charlotte, N. C., Traffic Engineer Herman Hoose has already put 8,550 signs of Alcoa Aluminum into service and is gradually replacing the last 450 made of steel. He spells out his reasons in dollars and cents.

Starting in 1950, records prove that rugged, corrosion-resistant Alcoa Aluminum makes signs last at least twice as long; twice the life means significant savings. Fabrication is cheaper because sign backs need no painting. Handling is easier because aluminum weighs less than half as much as steel. Finally, collision damage is repaired inexpensively by simply flattening signs to their original shape without stripping or refinishing.

Thirteen leading sign manufacturers are ready to help you cut costs as sharply as Charlotte has by supplying finished signs of Alcoa Aluminum—all ready to erect. Call the one nearest you, or write: Aluminum Company of America, 1682-H Alcoa Bldg., Pittsburgh 19, Pa.

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ALTERNATE SUNDAY EVENINGS

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Gopher Stamp & Die Co.
78 Chicago Avenue, E.
St. Paul, Minnesota

The Grote Manufacturing Co., Inc.
500 Lafayette Avenue
Bellevue, Kentucky

The Hunt Company
18308 James Couzens Hwy.
Detroit 35, Michigan

Lyle Signs, Inc.
2720 University Ave., S. E.
Minneapolis 14, Minnesota

Minnesota Mining & Manufacturing Co.
900 Fauquier Avenue
St. Paul, Minnesota

Mulholland-Harper Co.
5820 Tacony St.
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National Safety Engineers, Inc.
3910 First Ave., South
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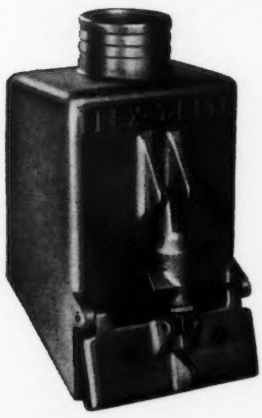

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Traffic Engineering

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

Vol. 27 AUGUST, 1956 Number 11

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COVER: *Modern street lighting on West 4th Street, Winston-Salem, North Carolina.*

DEFINITION: Traffic Engineering is that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods.

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For extra value get **DUAL**

PARKING METERS

Frankly Speaking . . .

UNDER THE EXPANDED national highway program, freeway design can be brought to bear on the urban traffic jam at a much faster rate. A note of caution should be sounded, however, amid the elation with which this prospect is greeted.

Doubtless these modern limited-access arterials offer the best hope of breaking metropolitan bottlenecks—of providing a more satisfactory level of transportation service in general. But unless in the future a better job is done in correlating design to operational needs at the blueprint stage, we may be paving the way for new traffic confusion on a massive scale.

The fact is that for many motorists, driving on these superhighways is often a troublesome experience. Even in cities where freeways and expressways have existed for some time, drivers are frequently perplexed due to intricacy of interchanges and lack of proper signing and lighting.

It must be kept in mind that the motorist who must negotiate such complex structures—whether cloverleaves, diamond, trumpet, direct or any other of the wide variety of interchanges—is operating on a high-speed facility. His decisions as to movements and maneuvers likewise must be high-speed. He cannot make the decisions safely and efficiently without the guidance of adequate control devices. Proper signs must give him necessary information well in advance, or he is faced with a problem every time he wants to get on or off a facility, go from one freeway to another, or from a limited-access route onto the local street system.

The time to plan a control device system for the limited-access highway is when the facility itself is being planned. The operational aids should be integral with its geometric design features. Otherwise the location and design of interchanges, ramps, etc., may result in such complicated situations that intelligible signing becomes an impossibility. To guide motorists being channeled by an interchange to different destinations, for example, several signs may be necessary at a single point. And obviously such a conglomeration is self-defeating and dangerous for cars cruising at an expressway speed of 50 miles an hour.

All of which means that if our superhighways of tomorrow are to repay the heavy investment in terms of safer, faster and more economical transportation, the lack of coordinated planning must be remedied without delay. Resolute steps must be taken to close the glaring gap that now exists between expressway design, operational planning and—last but not least—the motorist's present limited knowledge of how to use these modern facilities.

GORDON K. GRAVELLE
Director, District II

55,000 Vehicles per day

Baltimore's busy Park Circle handles 55,000 vehicles in an average day on six converging approaches. The problem is intensified because of heavy reversals of directional flow and fast developing peaks. Add the seasonal traffic to and from Maryland's famed Pimlico Race Track, the burden of feeder routes to rapidly growing residential sections, and you have the elements of a real problem intersection.

Write for Bulletin C-115-B

It takes a 1033 to handle the really tough ones!

AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INCORPORATED

NORWALK, CONNECTICUT

PROGRAM

(Tentative)

26th Annual Meeting, September 25-27, 1956
San Francisco, California

Tuesday September 25 . . .

9:30 a.m.	Opening

Session No. 1 — A LOOK TO THE FUTURE

10:15 a.m.	"The Urban Area of the Future"
10:45 a.m.	"The Urban Transportation System of the Future"
11:00 a.m.	"The Challenge to the Traffic Engineer"
12:10 p.m.	Kickoff Luncheon

Session No. 2 — URBAN TRANSPORTATION PLANNING AND TRAFFIC ENGINEERING RESPONSIBILITY FOR TRAFFIC SAFETY

2:00 p.m.	"The Effect of the Expanded Federal Highway Improvement Program on Traffic Engineering"
2:40 p.m.	"Metropolitan Area Transportation Studies"
3:30 p.m.	"The Role of the Traffic Engineer in Subdivision and Shopping Center Planning"
4:10 p.m.	"Traffic Safety — An Engineering Responsibility"

Wednesday, September 26 . . .

7:30 p.m.	Biscuit Banter Breakfast

Session No. 3 — CONCURRENT SESSIONS OF TECHNICAL COUNCIL DEPARTMENTS

9:15 to 11:45 a.m.	Sessions arranged by Vice President Havenner and Department Heads — seven concurrent sessions operating as workshops.
Afternoon	Field Trip

Thursday, September 27 . . .

9:00 a.m.	Annual Business Meeting (members only)

Session No. 4 — WHAT'S NEW IN TRAFFIC ENGINEERING

1:30 p.m.	"Automation in Traffic Control"
2:10 p.m.	"Research on Operating Characteristics of Freeways"
3:00 p.m.	Solutions to Specific Problems — A panel presentation featuring a number of younger members of the Institute.
6:00 p.m.	Annual Banquet

Improving Seeing Efficiency with Roadway Lighting

By Charles H. Rex (Mem., ITE)

Street Lighting Development Engineer, Outdoor Lighting Department, General Electric Company

NOTE: *The following paper is one of a series of articles which will present a modern and up-to-date revision of previous ITE contributions such as, "Technical and Practical Aspects of Highway Lighting"—ITE Proceedings 1937; Traffic Engineering Handbook Section on Highway Lighting 1941 and 1950; "Modern Lighting for Residential Streets" ITE Proceedings 1945; and paper "Roadway Lighting for Efficiency" presented before ITE Annual Meeting Sept. 11, 1952. The author is currently a member of ITE Committee on Street and Highway Lighting and Chairman of I.E.S. Sub-Committee on Roadway Lighting Principles. He is member and Past Chairman of both the I.E.S. Committee Street and Highway Lighting and its Sub-Committee on Standard Practice.*

"OPEN AFTER DARK" operation of our motor vehicle transportation business is an obvious economic and social necessity. Success in this business involves good roadway lighting. The type of lighting and the extent of its use will depend upon recognition and knowledge of its benefits in improving night traffic conditions.

The action programs which are so obviously essential now will be developed at a more rapid future pace. Progress will be accelerated if there is a clear and general understanding of the problem of providing efficient, pleasant and attractive night driving conditions.

Accountability for Action

Accountability and responsibility to the public is in the capable hands of engineers and officials employed by governmental agencies and other organizations or associations. You all are interested in extending and expanding the night use of facilities for motor vehicle transportation.

Realization of the objectives and benefits of roadway lighting in terms of improved seeing and improved traffic conditions will be aided by numerical ratings of the extent of such improvement. Many more people could use our roadways at night if conditions were improved for seeing and for night living with motor vehicle transportation.

Night Transportation is Essential For Night Living

Night living takes on new and even greater significance when future night traffic conditions are anticipated. The traffic engineers predict that motor vehicle traffic will increase by one-third by 1965 and double in volume by 1975. The seeing comfort, convenience and accident prevention value of roadway lighting will influence the night use of the multibillion dollar investment which the people have made in streets, highways, autos, trucks, and buses. The value of this investment depends upon the night usefulness desired by the people. (Your automobile is of small social or economic value sitting in a garage.)

For existing roadway systems and new streets and highways now in the planning stage, a careful study of night seeing is vital. Obviously the human efficiency of the drivers is a basic consideration for progress.

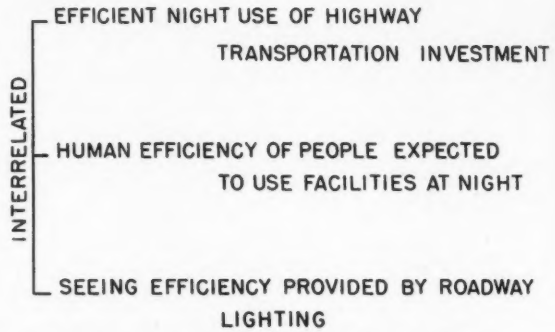

EFFICIENT NIGHT USE OF HIGHWAY TRANSPORTATION INVESTMENT
INTERRELATED
HUMAN EFFICIENCY OF PEOPLE EXPECTED TO USE FACILITIES AT NIGHT
SEEING EFFICIENCY PROVIDED BY ROADWAY LIGHTING

Fig. 1
Present and future efficiency or value of multi-billion dollar investment in motor vehicle transportation is dependent upon efficiency of driver, and seeing efficiency provided by roadway lighting.

Three Interrelated Efficiencies

Fig. 1 diagrams the basic interrelation between (1) the efficient night use of the public investment in its highway system and vehicles; (2) the efficiency of the people who are expected to use these transportation facilities at night; and (3) the seeing efficiency provided by roadway lighting. Each is dependent upon the other.

Comfort

Seeing efficiency involves the comfort quality of driver seeing. This deserves greatly increased attention. The psychological and physiological condition of the driver is oversimplified by the word "alertness" in Fig. 2. The necessary seeing depends upon the more obvious adverse factors such as fatigue, monotony, carelessness, poor driver vision, lack of concentration, inattention, bad judgment, slow driver reaction and even intoxication. Poor seeing may induce and accentuate the effect of these and other adverse factors. Good seeing generally alleviates such conditions, making night driving easier, less tense, more pleasant and attractive, with greater freedom from fear or annoyance. Such favorable conditions may help maintain driver alertness. Some safety factor in comfort should be provided. Comfort is one of the principal night-driving objectives. In many instances it applies to the pedestrian as well as the driver.

Traffic comfort is the comfort which the Virginia Department of Highways feature on their detour signs which say:

THIS CONSTRUCTION IS FOR YOUR FUTURE *COMFORT* AND *SAFETY*. DRIVE CAREFULLY.

This is the comfort objective which sells automobiles, sells smooth, pleasant, attractive streets and highways. It should be an important objective in the use and choice of roadway lighting.

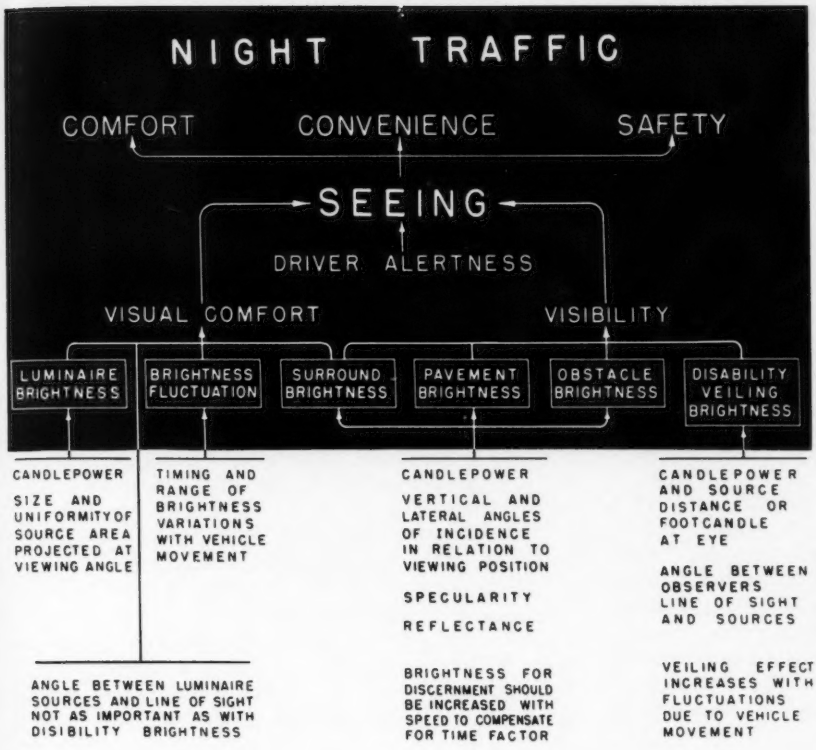

NIGHT TRAFFIC
COMFORT
CONVENIENCE
SAFETY
SEEING
DRIVER ALERTNESS
VISUAL COMFORT
VISIBILITY
LUMINAIRE BRIGHTNESS
BRIGHTNESS FLUCTUATION
SURROUND BRIGHTNESS
PAVEMENT BRIGHTNESS
OBSTACLE BRIGHTNESS
DISABILITY VEILING BRIGHTNESS
CANDLEPOWER
SIZE AND UNIFORMITY OF SOURCE AREA PROJECTED AT VIEWING ANGLE
ANGLE BETWEEN LUMINAIRE SOURCES AND LINE OF SIGHT NOT AS IMPORTANT AS WITH DISIBILITY BRIGHTNESS
TIMING AND RANGE OF BRIGHTNESS VARIATIONS WITH VEHICLE MOVEMENT
CANDLEPOWER
VERTICAL AND LATERAL ANGLES OF INCIDENCE IN RELATION TO VIEWING POSITION
SPECULARITY
REFLECTANCE
BRIGHTNESS FOR DISCERNMENT SHOULD BE INCREASED WITH SPEED TO COMPENSATE FOR TIME FACTOR
CANDLEPOWER AND SOURCE DISTANCE OR FOOTCANDLE AT EYE
ANGLE BETWEEN OBSERVERS LINE OF SIGHT AND SOURCES
VEILING EFFECT INCREASES WITH FLUCTUATIONS DUE TO VEHICLE MOVEMENT

Fig. 2
Objectives and factors involved in successful operation of night traffic for user comfort, convenience, and safety depend upon the seeing factors, visual comfort, driver alertness, and visibility. Control of factors such as luminaire brightness, disability brightness, fluctuation at the driver's eyes with vehicle movement, and build-up of pavement brightness and obstacle brightness factors improves seeing efficiency.

Convenience

Quality of traffic flow is another traffic benefit of roadway lighting. Good seeing may expedite traffic and help relieve congestion. It provides higher safe or "critical" vehicle operating speeds during night hours. These speeds may be 10 to 20 miles per hour higher than when seeing conditions are poor. The economic value of the time thus saved amounts to many thousands of dollars per mile of roadway per year.

Understand the Benefits of Roadway Lighting

When designed for good seeing, roadway lighting will encourage and increase night use of our roadway system, distributing a portion of the traffic loads to the night hours. Proper vehicle headways, spacing, use of full pavement width, proper lanes, and use of available safe passing opportunities are some of the operational and capacity benefits. A lighted roadway background or "vehicle-path" aids judgment of speed and direction of vehicles. It also tends to minimize any adverse effect of bright lights in the field of view.

Safety

Roadway lighting aids law enforcement. It is also very convenient for those who might otherwise be timid about "flat tires," "on the journey troubles" or nocturnal crime.

The traffic safety benefits of good seeing are generally well known. The prevention of night accidents involves seeing the situation soon enough and far enough in advance to avoid collision. This sight distance generally involves visibility safety factors of brightness or brightness contrasts which are sufficient for quick and certain discernment. Knowing the route or vehicle path ahead, the roadway contour, and alignment often makes the difference between a hazardous or safe condition for the driver and the "other fellow" whether he be driver or pedestrian.

In comfort, convenience, and safety, the night traffic objectives of roadway lighting shown in Fig. 2 are similar to those which provide the background for other work being done in traffic engineering, in street and highway construction and modernization, and in automobile design and development.

Seeing Efficiency Must be Evaluated

The night traffic situation makes ratings for the seeing and traffic effectiveness of roadway lighting an impelling obligation. Such ratings should be in terms consistent with the overall night transportation benefit provided. Evaluations of such benefits provided by several types of good roadway lighting should be compared with the seeing under poor roadway lighting, or with no roadway lighting at all. This is the consensus of a group of members of the Technical Advisory Committee for the Illuminating Engineering Research Institute, also the members of the I.E.S. Subcommittee on Roadway Lighting Principles.

"Figures of merit" for various levels of seeing will help establish the numerical proof or rating on which the improvement of good roadway lighting should be based. These figures of merit will also improve night driving conditions consistent with traffic and social requirements.

Traffic engineering aid is solicited in rating all aspects of seeing evaluation. Many members of I.T.E. have had considerable experience in measuring or estimating the visibility and brightness factors in roadway lighting listed near the mid-portion of Fig. 2. Also, some I.E.S. members have accumulated data pertaining to the traffic benefits shown at the top of Fig. 2. Rating is a big job even when all branches of the business participate; however, it is a mutual obligation.

Rating and Assessment of Benefit

Some work in the overall assessment and rating of seeing with roadway lighting has been underway for many years. Increased work on some phases of the problem has been scheduled for several well qualified agencies including university research laboratories. The Illuminating Engineering Research Institute is one sponsor. This Institute, with the

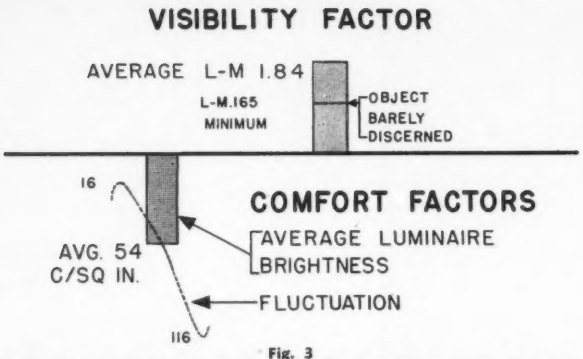


Fig. 3
Rating for representative roadway lighting system in terms of seeing factors: Longitudinal average of combined luminaire brightness, and fluctuation of combined luminaire brightness along driver eye-level with vehicle movement along roadway, and longitudinal average relative visibility. Above ratings do not include depreciation factors for accumulation of dirt on luminaires or loss of lamp light output at end of rated life.

help of its Technical Advisory Committee on Light and Vision, and others are developing a comprehensive over-all research program. The Yale Bureau for Highway Traffic has offered to undertake certain phases of the investigation and assessment program. Much of this urgently accelerated program has been initiated by the I.E.S. Committee on Street and Highway Lighting and its Sub-Committee on Roadway Lighting Principles. *Evaluation should be expedited much more generally and with the heavy emphasis which the problem warrants.*

Your Problem

Evaluation of the relative importance of seeing comfort and visibility should obviously involve traffic engineers, the public, those responsible for the installation and operation of roadway lighting, and those responsible for the successful night operation of our motor vehicle transportation systems.

Visual Factors in Seeing

Performance data pertaining directly to the seeing objectives of roadway lighting systems can be presented using the outline shown in the mid-portion of Fig. 2. Such data should have a common basis consistent with the roadway, its lighting, the vehicle, and the driver. Many of these factors are interdependent.

Rating Involves Numbers for Visibility and Comfort Factors

A numerical rating for the seeing effectiveness of roadway lighting systems has long been desired. Such seeing ratings are essential to progress. As soon as data and sufficient correlations thereof are made available, such *ratings* will be established in terms of over-all seeing.

In the meantime, certain factors may be calculated using the best data currently available and a method described in the I.E.S. National Technical Conference paper "Luminaire Light Distribution Principles" published in *Illuminating Engineering*, December, 1955. This includes references and footnotes. Individual copies of reprints will be furnished upon request.

The principal seeing factors which may be evaluated are:

1. Visual Comfort Factors:
   a. Luminaire Brightness
   Brightness Fluctuation
2. Visibility

The ratings for a representative roadway lighting system are shown in Fig. 3. The numbers are the longitudinal average of the data shown in Fig. 4 and Fig. 5.

Luminaire Brightness Rating

The comfort factors, luminaire brightness, and brightness fluctuation may be presented graphically as shown in Fig. 4. This illustration shows the variation in the combined brightness of several luminaires in the driver's field of view as he travels (from left to right) along a representative roadway tive roadway path.

The *combined luminaire brightness averages 54.6* candles per square inch. The "flicker" or *fluctuation ratio is 7.25 to 1.* The 116 candle per square inch maximum may be most significant. The brightness peaks successively at intervals of 2 seconds for a driver traveling at about 40 miles per hour along the roadway lighting system assumed to be representative. The Fig. 4 data includes the brightness of luminaires at distances including 10.5 MH, generally about 315 feet. The luminaire brightness data assumes a constant 100 square inch projected area of luminaire light sources.

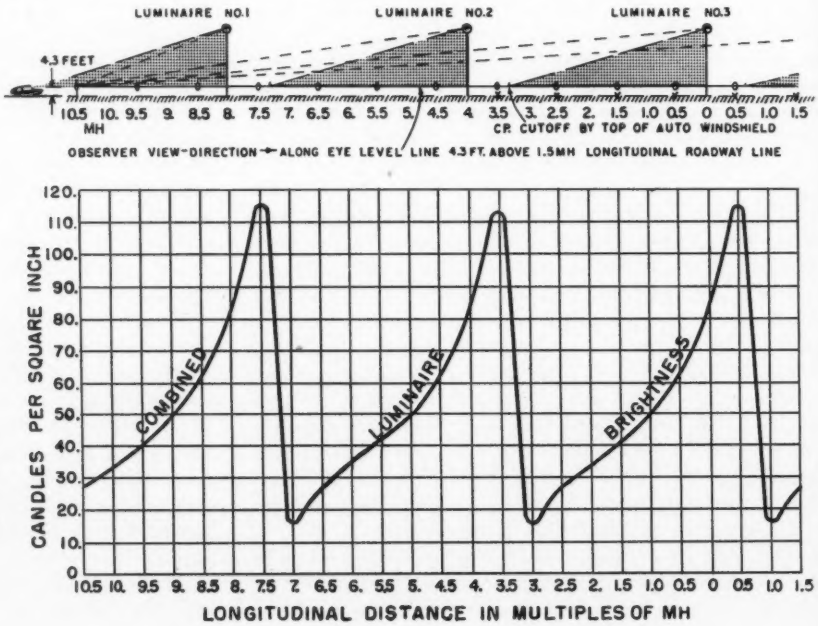


Fig. 4
Combined luminaire brightness and fluctuation as the driver-observer proceeds along a lighted roadway averages 54 candles per square inch with fluctuation ratio of 7 to 1. Luminaire light source area is assumed constant at 100 square inches. At some locations, as indicated, brightness is shielded from view by top of automobile windshield.

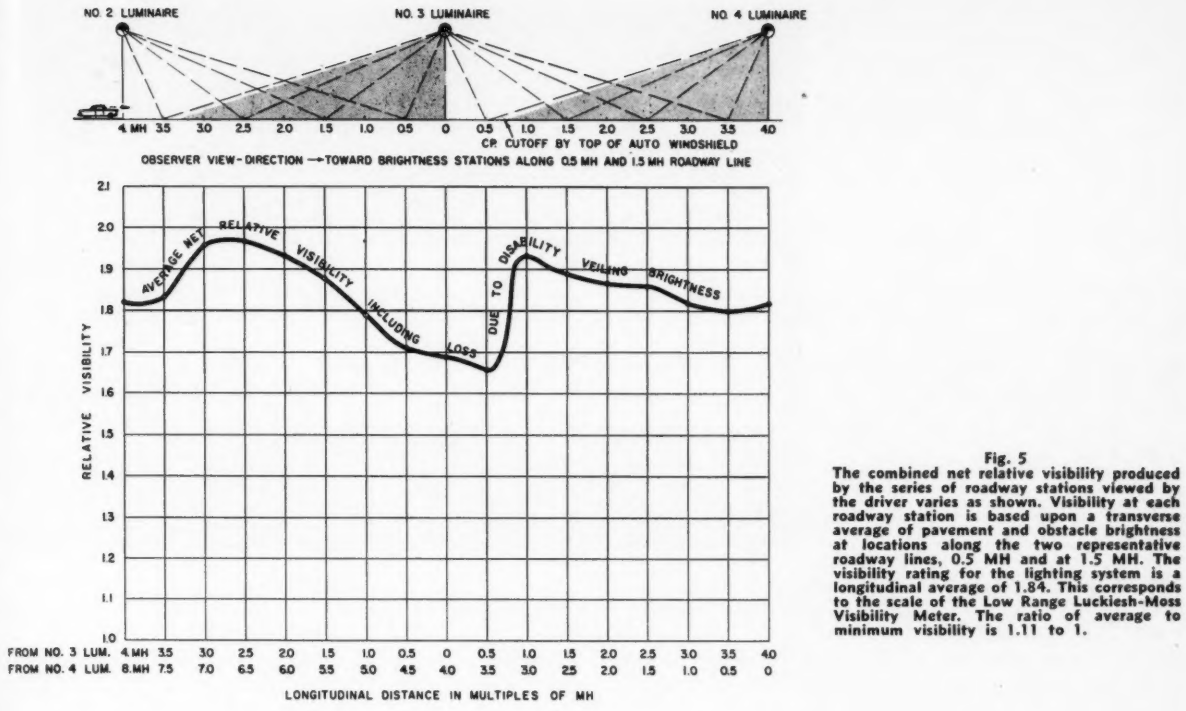

NO. 2 LUMINAIRE
NO. 3 LUMINAIRE
NO. 4 LUMINAIRE
4 MH 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
C.P. CUTOFF BY TOP OF AUTO WINDSHIELD
OBSERVER VIEW-DIRECTION →TOWARD BRIGHTNESS STATIONS ALONG 0.5 MH AND 1.5 MH ROADWAY LINE
RELATIVE VISIBILITY
AVERAGE NET RELATIVE VISIBILITY INCLUDING LOSS DUE TO DISABILITY VEILING BRIGHTNESS
2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3 1.2 1.1 1.0
FROM NO. 3 LUM. 4 MH 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
FROM NO. 4 LUM. 8 MH 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0
LONGITUDINAL DISTANCE IN MULTIPLES OF MH

Fig. 5
The combined net relative visibility produced by the series of roadway stations viewed by the driver varies as shown. Visibility at each roadway station is based upon a transverse average of pavement and obstacle brightness at locations along the two representative roadway lines, 0.5 MH and at 1.5 MH. The visibility rating for the lighting system is a longitudinal average of 1.84. This corresponds to the scale of the Low Range Luckiesh-Moss Visibility Meter. The ratio of average to minimum visibility is 1.11 to 1.

Visibility Rating

The net relative visibility for the same roadway lighting system is shown in Fig. 3 and Fig. 5. So as to be representative of the traffic-used portions of the pavement, the brightness along two roadway lines is averaged in obtaining the visibility rating as it varies for the driver traveling along the roadway. The longitudinal average *net visibility rating for the system is 1.84.* The *ratio of average to minimum is 1.11:1.* The numbers are based upon the scale of the Low Range Luckiesh-Moss Visibility Meter as will be explained later.

These ratings for representative types of lighting systems may be compared with those calculated for other types. Such ratings may be compared with the preferences of those who use the roadways at night. They may also be compared with the effectiveness of the roadway lighting system in producing the traffic comfort, convenience, and safety objectives.

Visibility and Low Brightness Will Be Seen and Appreciated

Visibility and the brightness of luminaires in the field of view can be seen and appreciated. Comparison of these seeing factors as provided by modern roadway lighting, versus poor lighting, versus no roadway lighting, should also produce an answer of general interest.

Basis for Simplification of Seeing Evaluation

The use of roadway lighting will be simplified considerably by using the interrelated factors in seeing as a basis for evaluation and prescribing performance. Data such as Fig. 3, Fig. 4 and Fig. 5 are based upon a representative roadway and lighting plan as shown in Fig. 6. The eyes of the driver-observer as he travels along the roadway are depicted by the eye-level longitudinal line which is 4.3 feet above the roadway pavement surface. With 30-foot luminaire mounting height (MH), this line is .143 MH above the pavement. The eye-level line and the driver's path is at a transverse distance of 1.5 MH (45 feet) with respect to luminaires on the left such as Nos. 1 & 3 and at 0.5 MH (15 feet) with respect to luminaires on the driver's right such as Nos. 2 & 4.

The 4.3-foot eye-level height is based upon a 51.7 inch average driver eye height in 25 makes and models of American cars, as of June, 1955, according to information kindly supplied by T. J. Carmichael, Engineering Staff, General Motors Technical Center, Detroit, Michigan.

For information with regard to roadway lines, distance in relation to MH (mounting height) and the 4 MH (120 foot) staggered spacing, refer to "American Standard Practice for Street and Highway Lighting" approved February 27, 1953, by the A.S.A.

Auto Windshield Cutoff Helps

As indicated at top of Fig. 4 the data are based upon top of auto windshield cutoff of brightness from luminaires at distances closer than 3.3 MH. This is approximately the distance at which the vertical angle of 76 degrees intercepts the driver's eye-level line. Data available at present on 1955 cars indicate that the following quote from 1941 edition of the "Traffic Engineering Handbook" is approximately correct according to K. A. Stonex, General Motors Proving Grounds: "The angle from the vertical at which the top of automobile windshield cuts off light which would otherwise strike the driver's eyes is about 76 degrees." This reduces the average luminaire brightness and disability veiling brightness in the driver's eyes even though it is partly responsible for the peaks shown in Fig. 4 and Fig. 8.

The luminaire light distribution used is hypothetical. Except for an increase of each candlepower value by 2.5, this over-all light distribution is similar to that shown in the isocandle diagram, Fig. 15, Appendix, American Standard Practice for Street and Highway Lighting, 1953.

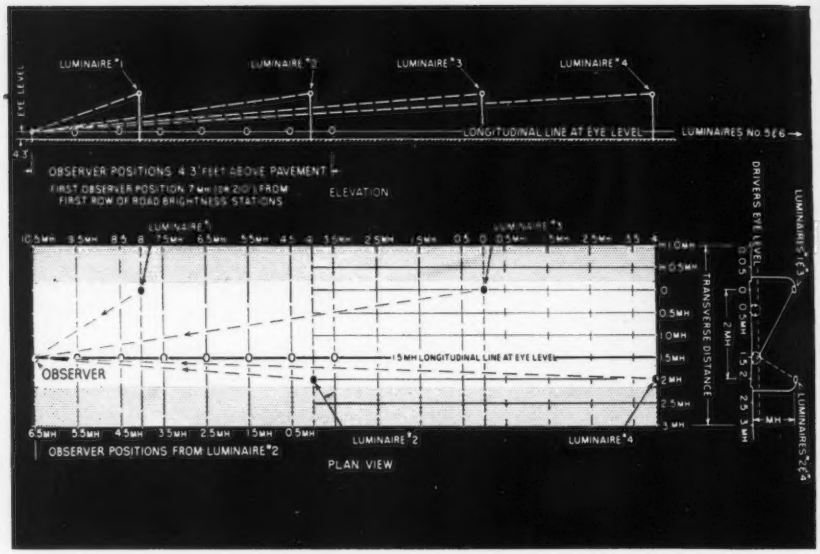


Fig. 6
Representative roadway layout showing the series of driver-observer viewing positions along the longitudinal eye-level line 4.3 feet above the pavement and at transverse distance of 1.5 MH (45 feet) with respect to luminaires on the driver's left, such as No. 3. This eye-level line is also at 0.5 MH (15 feet) with respect to luminaires on the driver's right such as No. 4.

Luminaire Candlepower Should be Shown in Inclined Planes

Fig. 7 shows the candlepower distributed along the longitudinal eye-level line from luminaires at the driver's left such as No. 1 or No. 3, etc. This candlepower curve is in an inclined plane to eye-level line designated 1.5 MH, shown in this perspective diagram. Such candlepower data will now be furnished for evaluation of luminaire performance.

Lighting System Combines Eye-Level Effect of Candlepower

Obviously at any specific longitudinal driver-observer viewing position there is candlepower impinging upon the driver's eyes from several luminaires. Fig. 7 inclined plane is for candlepower from luminaires on the driver's left. The inclined plane for candlepower distribution from luminaires along the driver-observer's right hand side is designated 0.5 MH corresponding to the transverse distance of the eye-level line with respect to luminaires such as No. 2 or No. 4, etc. Thus only two candlepower-to-eye-level light distributions are required for this representative roadway lighting system. The candlepower is plotted along radial lines extending from the luminaires to the uniformly spaced driver viewing positions along the eye-level line as shown in Fig. 6 and 7. Obviously the candlepower distribution may also be shown in rectangular coordinates, or may be presented in tabulations. The latter facilitate conversion from candlepower to candles per square inch of projected luminaire source area (Fig. 4) or footcandles at the eye for disability veiling brightness, Fig. 8.

Fig. 7 also shows the design control and restriction of the luminaire candlepower on the eyes of the driver-observer as he proceeds along the roadway. This applies to the candlepower at the higher angles projecting toward driver positions along the eye-level line, at longitudinal distances farther from the luminaire than the 3.3 MH top-of-auto-windshield cutoff.

Disability Veiling Brightness (D.V.B.)

The percent loss in visibility shown at the top of Fig. 8 is due to the disability veiling brightness shown in the lower portion of this illustration. The combined reduction in visibility by the roadway lighting system is as experienced by the driver traveling in the speed range of 25 to 40 miles per hour. The indications are that the fluctuations cause slightly greater visibility losses at higher speeds. This is from studies by Kirk M. Reid and H. J. Chanon, "Evaluation of Street Lighting" I.E. 34, 1939, 1200.

The longitudinal average loss in visibility is about 21 percent. The ratio of maximum to average loss is 36 to 21.5 or 1.67 to 1.

Fig. 8 also shows the manner in which the 3.3 MH top-of-auto-windshield cutoff aids the luminaire light distribution in control of candlepower thus restricting the D.V.B.

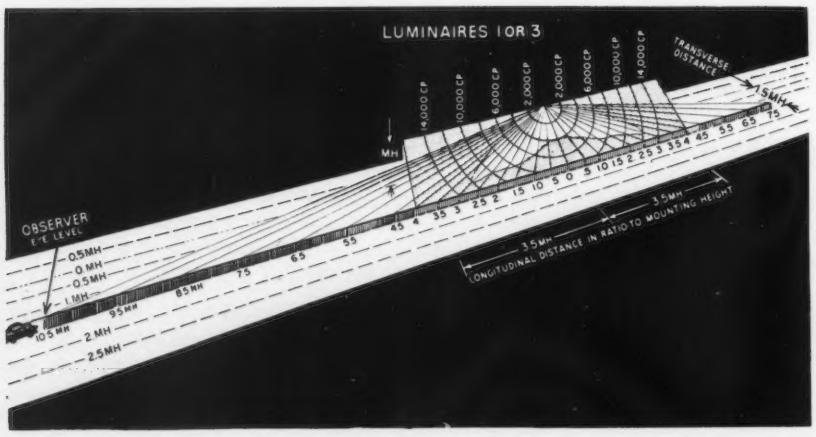


Fig. 7
Inclined plane light distribution curve, in perspective diagram showing control of luminaire candlepower along the driver-observer eye-level 1.5 MH line. Luminaire brightness is proportional to candlepower if projected area of luminaire light source is constant. The candlepower distribution is restricted at longitudinal distances from the luminaire greater than the 3.3 MH top of auto windshield cutoff. The light distribution used is hypothetical.

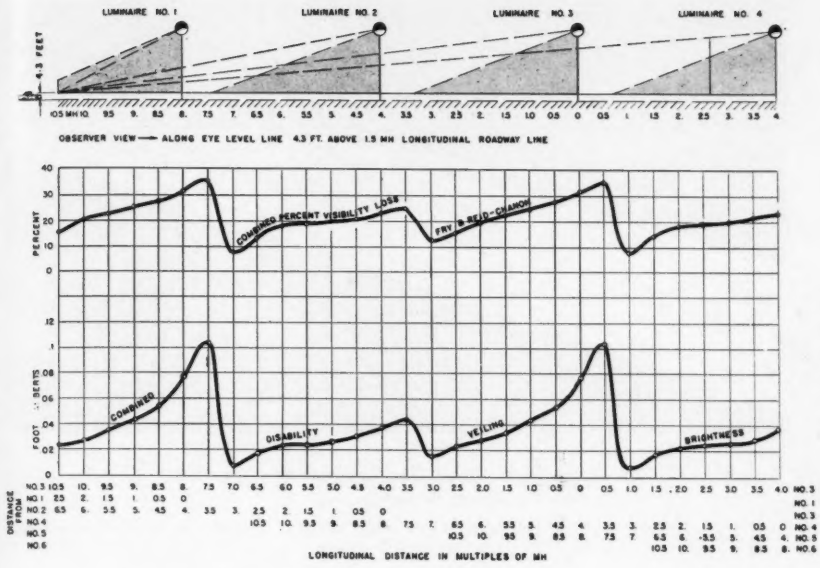


Fig. 8
Combined per cent loss in visibility due to disability veiling brightness. D.V.B. varies with longitudinal distance of driver viewing position from luminaires, top of auto windshield cutoff, and luminaire control of candlepower or footcandles at driver's eyes. For the assumed system the loss averages 21.5 per cent. The ratio, maximum to average, is 1.67 to 1. The per cent loss is for driver traveling 25 to 40 m.p.h. per Reid-Chanon data. Disability veiling brightness (D.V.B.) lower curve is from formula recommended by Dr. Glenn A. Fry on Feb. 10, 1956.

factor — footcandles at the driver's eyes. The longitudinal average combined disability veiling brightness (D.V.B.) is .037 footlambert. This and the percent loss in visibility is lower than that which the driver-observer would experience without the benefit of top-of-windshield cutoff.

Disability veiling brightness formula now being used is that recommended by Dr. Glenn A. Fry, February 10, 1956. This formula is:

$$\text{D.V.B. in Footlamberts} = \frac{31.4 \times E}{\Theta^2} \quad \text{or} \quad \frac{31.4 \times Cp. \times Lg.\ Distance}{\Theta^2 D^3}$$

$$\text{Illumination at the eye, } E = \frac{Cp}{D^2} \times \text{Cos. } \Theta$$

For Θ, D, etc. see Fig. 11, page 599 "Luminaire Light Distribution Principles" *Illuminating Engineering*, Dec. 1956.

Pavement or Obstacle Brightness Plus Factors in Visibility

Fig. 9 shows the basis for the positive (PLUS) factors in visibility (Fig. 5). These are the pavement brightness and obstacle brightness factors shown in Fig. 2. The two longitudinal roadway lines, 0.5 MH and 1.5 MH, are assumed to be representative of the traffic-used pavement areas of the typical roadway.

The road brightness stations designated X might be typical of those used for field measurement of pavement brightness. However the pavement and obstacle brightness data have been calculated at longitudinal intervals of 0.5 MH up to distances of 10.5 MH from each luminaire and then combined for the system. The driver-observer viewing of each pavement brightness station is from a distance of 7 MH, which with 30 foot MH is about 210 feet. At the 1.2 degree driver viewing angle the brightness at this pavement station is contrasted with the brightness of the vertical mid-portion of a 1 foot target or obstacle at a viewing distance of 6 MH. This 6 MH vs 7 MH longitudinal obstacle-pavement brightness relative comparison is also useful in field testing. The pavement brightness stations are considered basic.

The pavement and obstacle brightness at each of the roadway stations shown in Fig. 11 is a transverse average of

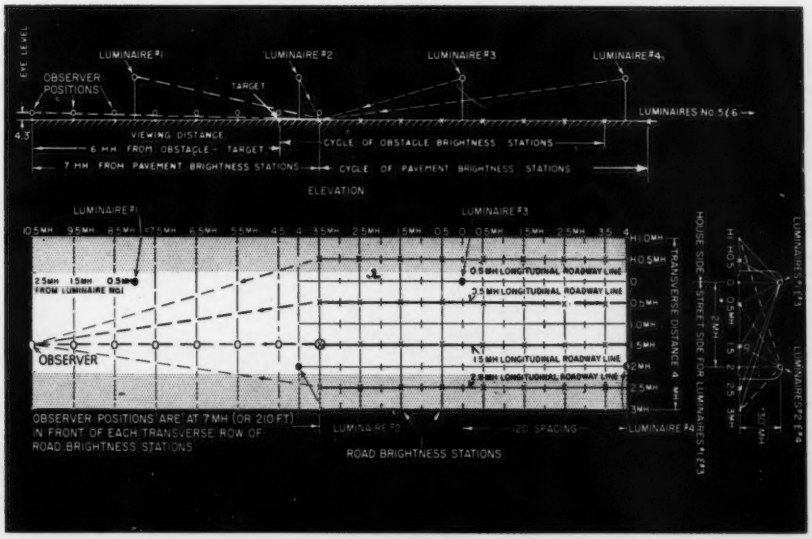


Fig. 9
Representative layout and conditions for calculation of "plus" factors in visibility. The major factor, pavement brightness is basic. For example, the visibility at stations at 3.5 MH longitudinal distance in front of luminaire No. 3 is correlated with the obstacle brightness at 4.5 MH and with the D.V.B. per cent reduction in visibility at 10.5 MH (or 2.5 MH). The brightness of obstacles at 4.5 MH stations is the same as at stations 3.5 MH beyond luminaire No. 3.

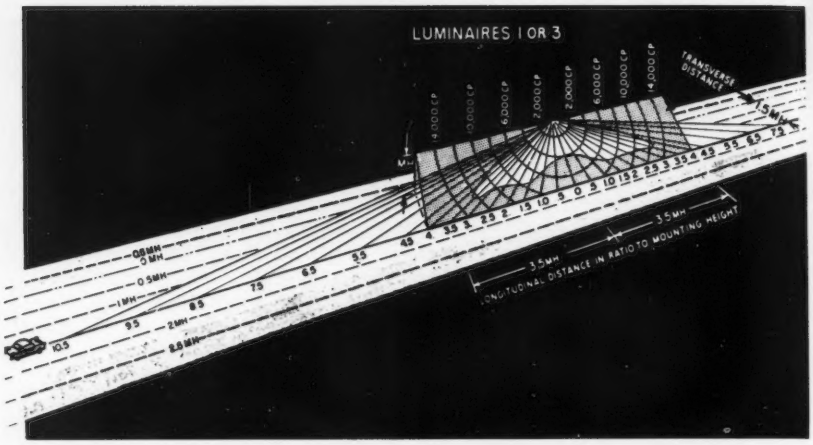


Fig. 10
Plus factor build-up and proportioning of luminaire candlepower distributed along 1.5 MH longitudinal roadway line is shown in an inclined plane light distribution curve. From specified driver-observer viewing position distances, variations in pavement brightness and obstacle brightness from specific surfaces will be proportional to variations in candlepower. The candlepower distribution curve shown is hypothetical. The brightness resulting from such candlepower distributions are combined to represent a system of several luminaires.

the combined brightness at the respective stations along the two longitudinal roadway lines, 0.5 MH and 1.5 MH.

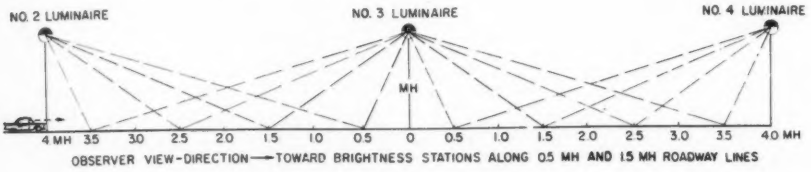
The brightness results from incident candlepower from luminaires along both sides of the roadway. The candlepower from each luminaire may be presented in inclined plane candlepower distribution curves such as that shown in Fig. 10. This candlepower curve is similar to that shown in Fig. 7 except to stations along the 1.5 MH longitudinal *roadway instead of eye-level line.* Only two such candlepower curves are required for the pavement brightness along the two roadway lines 1.5 MH and 0.5 MH.

Inclined Plane Candlepower Distribution Along Roadway Lines

Inclined plane candlepower curves such as that shown in Fig. 10 are independently useful. For example the brightness produced at a series of stations along a specific pavement surface will increase or decrease in proportion to an increase or decrease in the candlepower incident thereto. This assumes constant angles of driver-observer viewing. Hence the pavement brightness performance, or effectiveness of different candlepower distributions, in such planes may if desired be compared directly without the necessity of the customary intermediate brightness computations.

Combined Pavement Brightness for System

The combined pavement brightness (Fig. 11) is based


NO. 2 LUMINAIRE
NO. 3 LUMINAIRE
NO. 4 LUMINAIRE
MH
4 MH 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 MH
OBSERVER VIEW-DIRECTION—TOWARD BRIGHTNESS STATIONS ALONG 0.5 MH AND 1.5 MH ROADWAY LINES

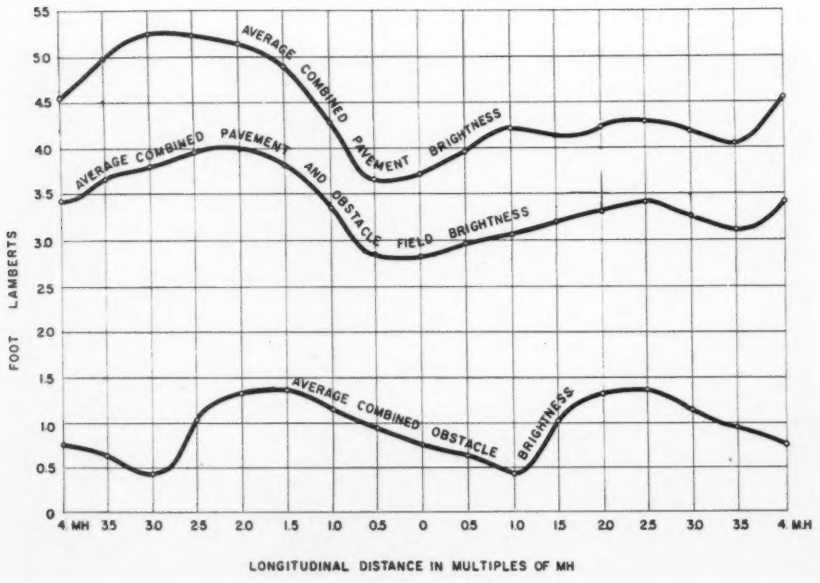

FOOT LAMBERTS
AVERAGE COMBINED PAVEMENT BRIGHTNESS
AVERAGE COMBINED PAVEMENT AND OBSTACLE FIELD BRIGHTNESS
AVERAGE COMBINED OBSTACLE BRIGHTNESS
4 MH 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4 MH
LONGITUDINAL DISTANCE IN MULTIPLES OF MH

Fig. 11
Average combined pavement brightness, average combined obstacle brightness, and the field brightness combination of pavement and obstacle brightness, for the representative roadway lighting system. The latter (middle curve) is sometimes called weighted field brightness. The brightness at stations along the 0.5 MH and 1.5 MH roadway lines are averaged transversely.

upon Reid-Chanon brightness data rearranged for the 0.5 MH and 1.5 MH (Fig. 9) roadway lines.

The pavement brightness data is for asphalt. The sample tested had been in service for 8 years. The over-all reflectance was 8 percent.

The longitudinal average of the *combined pavement brightness for the roadway lighting system* as shown in Fig. 11 is 0.442 foot lamberts. *The ratio of the average to minimum* is 1.2.

Obstacle Brightness for System

The combined obstacle brightness .Fig. 11) for stations along the two roadway lines is based upon an obstacle or target having a diffuse reflectance of 8 percent. *The longitudinal average obstacle brightness for the system is 0.096 foot lamberts. The ratio average to minimum obstacle brightness is 2.2.*

The transverse average of brightness at two pavement stations along the 0.5 MH and the 1.5 MH roadway lines is combined with the obstacle brightness at the two target locations at longitudinal distance one MH closer to the observer.

Fig. 12 compares the average pavement brightness for the system and the obstacle brightness. These two plus factors produce the L-M relative visibility average of 2.06. The 21 percent loss in visibility due to D.V.B. (disability veiling brightness) applies only to the relative combined visibility rating above 1.0. This results in loss in relative visibility of 0.22. The net relative visibility rating for the system is consequently 1.84 as shown at the right of this illustration.

Minimum Visibility May be the Criterion

The 1.66 minimum net visibility for the system, Fig. 3 and Fig. 5, is at the pavement brightness station at a longitudinal distance of 0.5 MH with respect to luminaire No. 3. *Perhaps roadway lighting systems will be rated in terms of minimum rather than average net visibility. The minimum rating should be adequate to provide visibility good enough to assure a reasonable safety factor for accident prevention.*

Above ratings do not include depreciation factors for accumulation of dirt on luminaires or loss of lamp light output at end of rated life.

The net relative visibility rating is based upon the scale of the Luckiesh-Moss low range visibility meter used in the Reid-Chanon studies. To quote:

> "A visibility of 1 (as applied to seeing for safety on streets) is defined as mere discernment of a one-foot obstacle of zero brightness on a background having a substantially uniform brightness of approximately 0.01 footlambert, by a stationary observer with normal vision standing 200 feet away at fixed attention with no source of direct glare in the field of view."

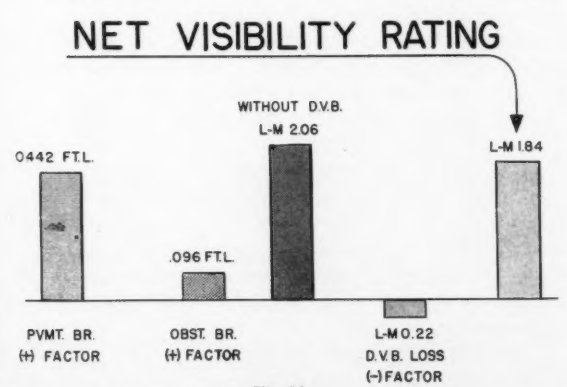


Fig. 12
Net relative visibility ratings for representative roadway lighting system is longitudinal average produced by plus factors pavement brightness and obstacle brightness minus reduction in relative visibility due to D.V.B. (Disability Veiling Brightness). Above does not include luminaire and lamp output maintenance factors.

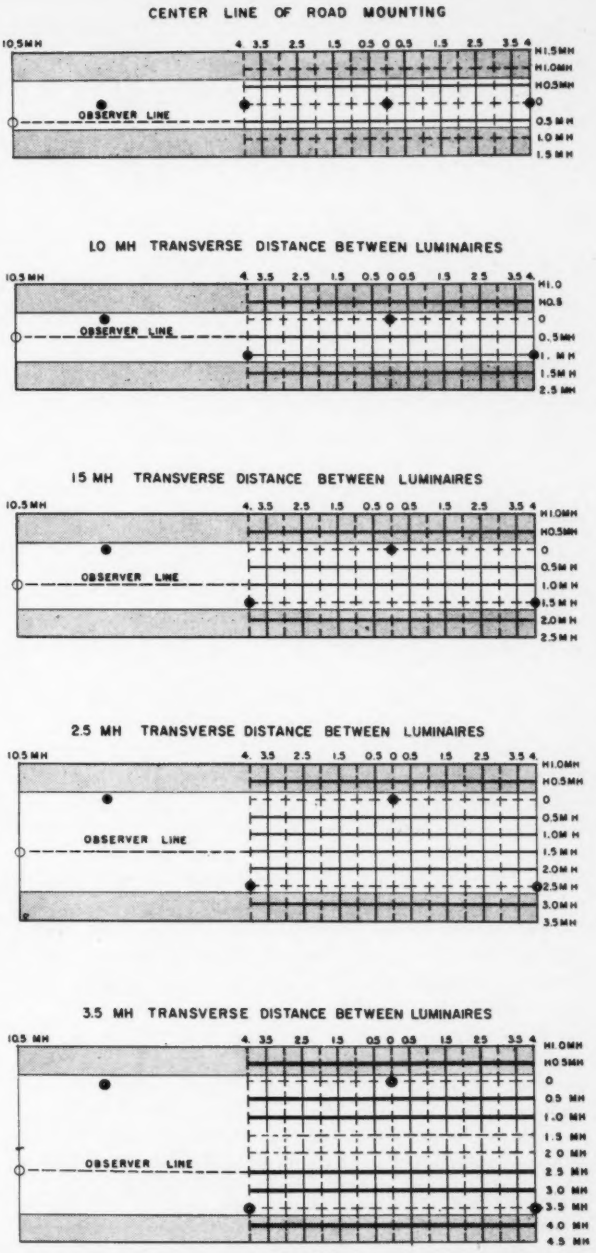


Fig. 13
Representative layouts of roadway lines and driver-observer eye position lines which will be used in rating factors in seeing with roadway lighting. This evaluation work will be done by I.E.S. Sub-Committee on Roadway Lighting Principles for user comparison and seeing factor estimates of other roadway lighting systems.

It may be that the I.E.S. Sub-committee on Roadway Lighting Principles will adopt a correlation of the L.-M. relative visibility ratings with a new scale of considerably larger numerical spread, i.e. 1 to 30 or 50.

Data is Based Upon Field Tests and Laboratory Studies

The foregoing calculations are based upon and compare quite favorably with field tests and laboratory studies using

(Continued on page 492)

One Year of Traffic Engineering in Arkansas

By Vealess F. Hudspeth (Jun. Mem., ITE)
Traffic Engineer, Arkansas Highway Department

ARKANSAS is facing —trafficwise — an ever-increasing variety of operational problems. The geographical characteristics of the State and the diversity of agricultural and industrial areas tend to complicate this traffic situation.

In 1955, the population of Arkansas was estimated to be 1,789,000. With mechanization of the farms, the population is rapidly shifting from rural to urban in character. The population-vehicle ratio for the State is 3.31, and the vehicle registration in 1955 was 573,852 with 396,231 passenger vehicles and 171,621 trucks licensed. The 29.7 percent truck registration indicates the agricultural nature of the State.

The primary and secondary systems consist of 10,028 miles of highways, with 2,412 miles as U.S. numbered routes (see figure 1). Of the total mileage, 9,400 miles are rural and 600 are urban. The proposed Interstate system includes 525 miles of Arkansas highways.

The large network of antiquated rural roads and the increasing congestion in urban areas are contributing factors to the State's accident rate: 7.3 deaths per hundred million vehicle miles as compared to the national average of 6.4.

The rapid increase in rural travel, 246 percent over a ten year period, has created many operational problems. Existing facilities are taxed to capacity in many areas, resulting in the high accident rate, delay, and congestion.

Many stopgap measures are being employed to meet the current demands of traffic. Pavements on all major routes are being widened to 24 feet, uphill truck lanes are being built on routes through the mountainous area of the northwestern section of the State, and the entire right-of-way width is being utilized through maintenance of adequate shoulders.

Administration

In 1952 the State Highway Department was divorced from politics and since that time has functioned as a nonpolitical body. Its administration is in the hands of a five-member Commission. The five members were appointed to serve two, four, six, eight, and ten year terms with a new Commissioner appointed each two years to serve a ten year term, thus perpetuating the original policies and plans of the group. The chief administrators serving under the Commission are the Director of Highways and the Chief Engineer.

Since 1952 the Highway Department has gradually passed through a period of adjustment and reorganization. On July 1, 1955, the ten maintenance districts were reorganized and consolidated into five highway districts. These districts carry on all maintenance and construction activities.

The Highway Commission's goal is to provide the people of Arkansas with a highway system to meet the demands of traffic of today and the future.

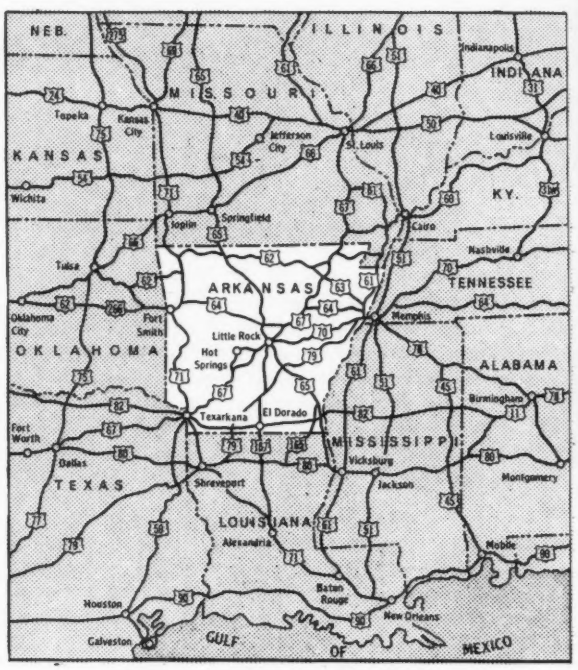


Fig. 1
Location of the 2412 miles of U. S. numbered routes in Arkansas.

Existing Traffic Engineering Functions

Throughout the history of the Highway Department the traffic engineering activities have been conducted by various divisions and sections. The existing traffic engineering functions and activities are performed by sections of the Division of Statistics and Analyses, the Division of Maintenance, and the Districts. The organizational chart shows the responsibility of traffic engineering functions (see figure 2).

The Traffic Section of the Division of Statistics and Analyses conducts the majority of traffic engineering activities. During the past year an engineering staff was added to this Section. The basic responsibility of this Section is to collect and analyze traffic data. Other responsbilities include accident studies, origin and destination surveys, special traffic studies, setting forth regulations and specifications for traffic control devices, and recommending traffic design of intersections.

The Traffic Service Section of the Maintenance Division is responsible for placing center stripes and the erection of signs. The Districts perform various traffic engineering functions principally in the maintenance of signs and requesting special traffic studies.

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6. Double-phase, extra-interval timer.

7. Single-phase, extra-interval timer.

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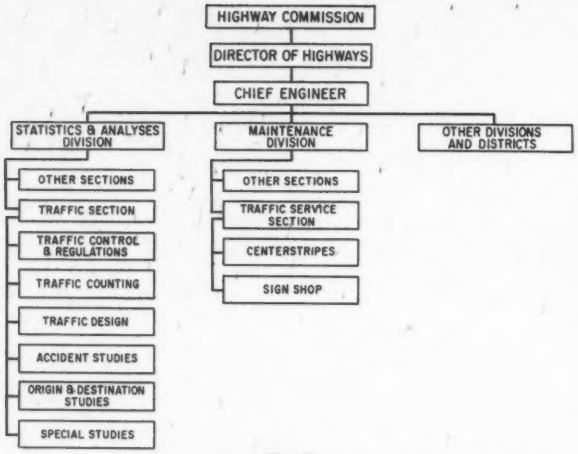

Fig. 2
Organization chart indicating existing Traffic Engineering activities.

A Proposed Traffic Engineering Division

The growth in operational problems has highlighted a need for the unification and definition of traffic engineering activities. Administrators of the Arkansas State Highway Department, accordingly, are seeking to develop a traffic engineering organization to cope with the traffic problems on the existing facilities and to plan for traffic in the future.

In setting up such a Division, an organzation should be created that would best fit the existing organization and carry out the duties and responsibilities of the Highway Department in operational activities.

It is proposed that a Traffic Engineering Division be created to carry out the operational functions. Figure 3 is a diagram showing the major functions of a proposed Traffic Engineering Division.

A summary of the general responsibilities of the Division would be:

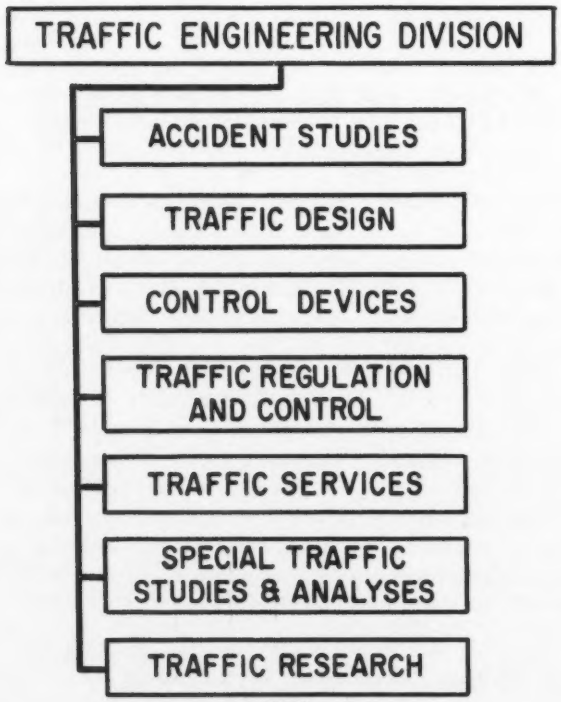

Fig. 3
A proposed Traffic Engineering Division.

1. Standardize traffic engineering practices.
2. Promote safe, orderly, and expeditious movement of traffic.
3. Conduct traffic and accident studies and prepare reports.
4. Furnish advice and guidance to District Engineers on traffic problems.

Request for Traffic Studies

Request for traffic studies are received by telephone, letters, and personal contact from local government bodies, civic groups, and individuals for investigation of traffic problems. All requests are investigated, regardless of nature, and a report is made of the findings with recommendations.

Accident Studies

During the past year records of accidents investigated by State Police were made available to the Traffic Section. All records are carefully screened to pinpoint the high accident locations. When such locations are found, a comprehensive study is made to determine whether any alterations can be made to reduce the accidents. Close cooperation with the State Police is maintained in reducing the mounting death toll in the State.

All accident locations are spotted on county maps (figure 4). These maps cover a period of three years with each year represented by pins of a particular color, which give a rapid presentation of accident locations and frequency of occurrence.

Accident reports are filed by counties as to route and section number of State highways. Reports of accidents within the city limits of incorporated towns and cities are not filed with the Highway Department.

Plans are now under consideration to record all accidents on IBM cards to provide a comprehensive coverage of all accidents as to type, location, nature of accident, etc.

Channelization

At many locations throughout Arkansas the change in traffic pattern and increase in traffic volume has made it necessary to redesign many of the intersections. These intersections developed high accident rates and during the peak hour there was delay and congestion.

A complete study of each intersection is made when the condition is brought to the attention of the Highway Department. Accident records are investigated for the past three years. A field study of traffic movements and a condition diagram are made and analyzed to determine the measures necessary to reduce the accidents and congested condition.

Seventeen intersections of those studied have been redesigned with recommendations for channelization. The work on these intersections is in various stages. There has been insufficient time to determine the degree of effectiveness. Recent accident data indicates a reduction in number and certain types of accidents occurring at the locations.

One of the major problems in installing channelization is the resentment of heads of local business firms. Many feel any alteration of the existing facility will have an adverse effect on their business.

An example of a change in traffic pattern and increased volume is found at the intersection of U.S. 70 and U.S. 67 near the city limits of North Little Rock. This change in pattern and volume occurred with the opening of the Little Rock Air Force Base.

Figure 5 is an aerial view of the intersection while under signal control. The intersection operated for four months with sandbags for channelization (see figure 6). Several

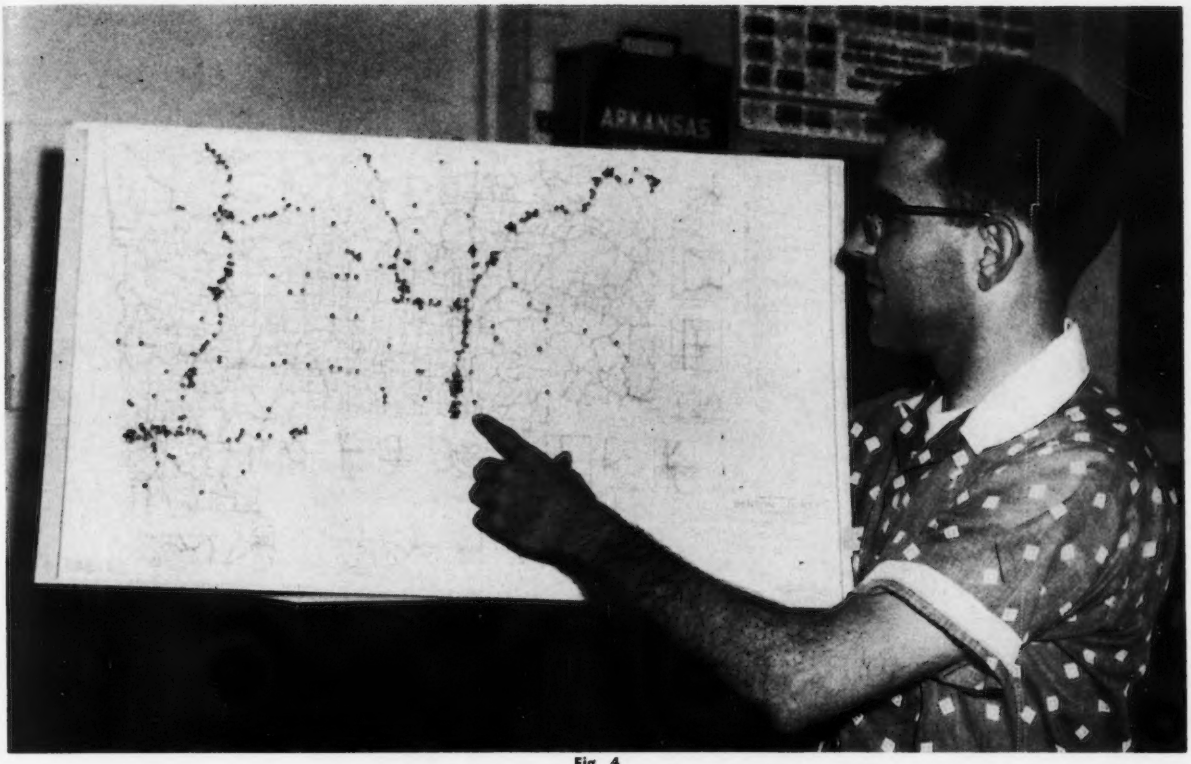

Fig. 4
Accident spot map showing high accident locations.

changes were made in the layout during this period and after satisfactory operation was obtained, a permanent installation of curbs and islands was made (see figure 7).

The intersection is controlled by a "Yield Right-of-Way" sign for the heavy left turning movement from U.S. 70 to U.S. 67E. A "Stop" sign controls the light left turning movement from U.S. 67E to U.S. 70. The right turns and through movement are allowed to move freely.

Signals

Signals throughout the State are erected and maintained by the local governments. The Highway Department has regulatory power over all signals erected on the State Highway System and prepares specifications and minimum warrants for the erection of the signals.

Many local officials and individuals believe the traffic signal is the panacea to all traffic ills. At many locations over the State, the local governments have erected signals without consulting the Highway Department. This has resulted in the installation of signals where they are unwarranted, a variety of types of signals, and timing without consideration to the demands of traffic.

Every effort is being made to assist local governments in providing adequate signal control at locations where signals are warranted. Special studies are made at each location where signals are proposed. When the opportunity presents itself, recommendations are made to provide adequate signalization where the existing signals are sub-standard or not

Fig. 5
Aerial view of Protho Junction before channelization.

EAGLE PEDESTRIAN SIGNALS

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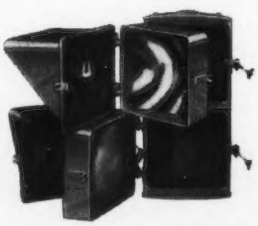

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timed properly. Several signals have been removed where conditions did not warrant their use.

In many of the towns, several signals have been erected at consecutive intersections along a State route without regard to progression or interconnection. In most cases this condition has had an adverse effect on the movement of traffic. Several of these locations have been studied and recommendations made for an interconnected system to provide the highest degree of progression.

When other measures have failed at high accident locations, caution signals have been installed on the critical approaches. The caution signals on the approaches to the intersection of U.S. 65 and U.S. 82 near Lake Village have proved to be very effective in accident reduction. The signal is made up of two units with alternate flashing operation.

Control of Access to Commercial Establishments

One of the major problems found throughout Arkansas was the lack of control of access to commercial establishments near intersectional areas. This condition prohibited the effective location of signs and allowed vehicles to enter the intersections at random, thereby creating a larger accident potential.

The State has regulatory power to control access to these establishments but lack of personnel and rapid growth in rural and urban areas had made control difficult. In recent years all construction and relocation work has been designed to exercise greater access control.

During the past year a booklet was drawn up setting forth the various conditions and regulations on control of access to commercial establishments. This booklet was drawn up after a careful study of the needs in Arkansas and regulations used in other states.

A wide distribution of the booklet will be sought to inform members of the Highway Department and the public of the regulations and requirements on the control of access to commercial establishments.

Origin and Destination Surveys

During the past year, five Origin and Destination Surveys were conducted. These surveys were made to provide information for future highway development and factual data to the local Planning Commissions.

Fig. 6
Sandbags for channelization were used for several months. Several alterations were made before construction.

Fig. 7
Channelization after permanent installation of curbs and islands.

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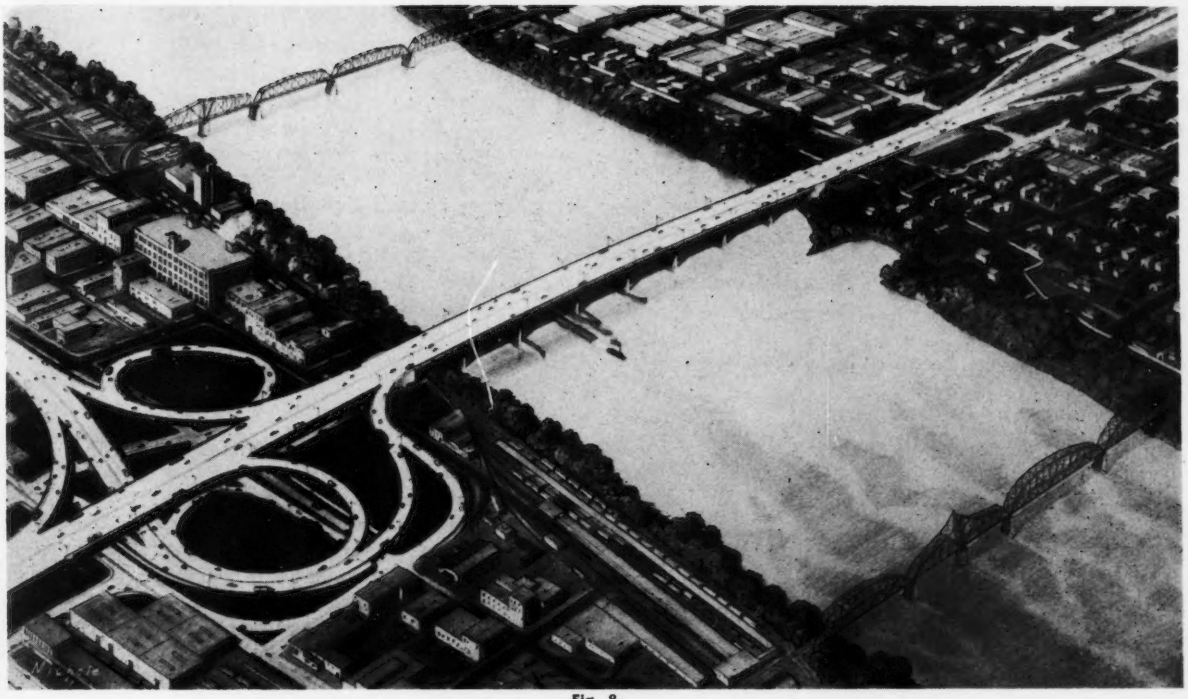

Fig. 8
Little Rock-North Little Rock Arkansas River Bridge with interchange on south approach.

Several types of surveys were conducted, including license plate surveys, short interview stations, and long interview stations. Extensive surveys were made at Jonesboro, Fort Smith, Blytheville, and Camden. The Camden survey was the short interview station (11:00 A.M. to 7:00 P.M.). A license plate survey was made at Monticello in conjunction with the study of a local traffic problem.

After each study a factual data report is prepared setting forth desired lines of travel and volume maps of the area.

Little Rock-North Little Rock Expressway

In March of this year the Highway Commission released the plan for a Greater Little Rock Expressway. All phases of the project were prepared by the consulting engineers, Brown and Blauvelt of New York.

The Expressway will free the city streets of through traffic converging from five Federal and State routes and will speed local rush hour traffic. It will include another bridge across the Arkansas River, relieving the congested condition on the two bridges that now exist (see figure 8).

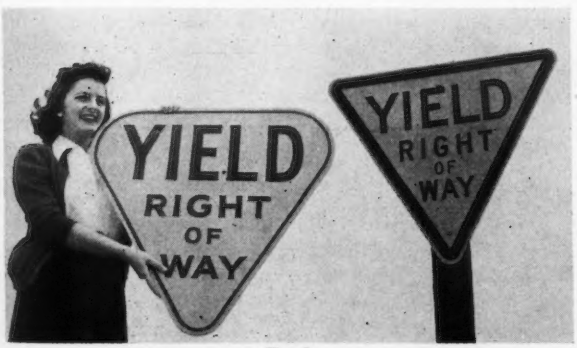

Fig. 9
Comparison of proposed "Yield Right-of-Way" sign and standard.

The Expressway will consist of three express lanes in each direction separated by a 24′-wide median strip. Service roads will be provided on each side to serve adjacent property and controlled access to the Expressway. The total length of the project is over five miles and includes the Arkansas River bridge which is approximately 1,570′ long. The project will have seven interchanges and the design speed is 60 MPH.

The total cost of the project is estimated to be over $52,000,000. The first phase of the project, which includes the bridge and connecting interchanges, is estimated to cost $28,000,000. This will be a part of the Interstate system.

Research

The Highway Department does not carry on an active research program. Research is generally conducted individu-

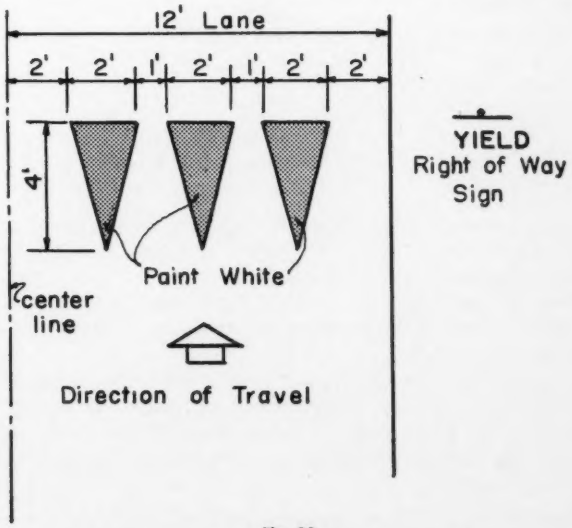

Fig. 10
Proposed "Yield Right-of-Way" pavement markings.

ally or in groups as a matter of interest.

The members of the Traffic Section conducted studies on redesign of the "Yield Right-of-Way" sign and pavement markings to be used in conjunction with the sign.

The Yield Right-of-Way sign was redesigned to use larger letters for the word "Yield". A comparison of the standard Yield sign and the proposed sign is shown in Figure 9. The sign is the same width as the standard sign and is five inches higher. Eight-inch letters are used for the word "Yield" (same as for "Stop" on the stop sign) compared to the five-inch letters on the standard sign.

Yield Right-of-Way pavement markings were also designed. Figure 10 shows a typical layout for a twelve-foot lane. The markings are similar in shape to the sign and are to be placed at the point where the vehicle is to yield the right-of-way. The triangles are to be painted white.

Conclusion

It is difficult to evaluate the efforts and accomplishments of one year of traffic engineering, especially on the State level, since many projects are under study or in various stages of planning. The evolution of progress of this nature is to a great extent dependent on time and demand for their evaluation.

Traffic engineering has progressed in many phases during the past year. The experience will contribute to better understanding and effective application of traffic engineering principles. This is especially true in setting up an effective Traffic Engineering Division to unify all activities.

IMPROVING SEEING EFFICIENCY WITH ROADWAY LIGHTING

(Continued from page 484)

instrumentation such as the Low Range Luckiesh-Moss Visibility Meter, the Luckiesh-Taylor Brightness Meter, etc.

One of the variables in seeing rating is the range of light reflection or brightness from the pavement surface. Modern roadway lighting uses special design techniques to produce good seeing with typical traffic-used pavement surfaces. However, some improvement in seeing may usually be obtained by special treatment of the pavement surface for favorable light reflection characteristics. Such special treatments are described in references such as No. 40, 42 & 46, "American Standard Practice for Street and Highway Lighting" 1953.

Seeing Ratings for Typical Roadway Lighting Layouts

The I.E.S. Sub-committee on Roadway Lighting is currently using this method of calculating and rating the *seeing* factor effectiveness of typical major classifications of roadway lighting and layout as shown in Fig. 13. These ratings may then be compared with average and minimum horizontal footcandles currently prescribed by the American Standard Practice for Street and Highway Lighting.

This Sub-committee now comprises:

P. B. Clark	Line Material Co.
W. H. Edman	Holophane Co.
H. E. Wall	City Detroit P.L.C.
F. D. Wyatt	Consulting Engineer
J. Young	New England Power Service
Charles Rex	Chairman
and ex-officio members:	
G. K. Glass	Detroit P.L.C.
D. W. Rowten	Westinghouse Electric Co.
T. J. Seburn	Yale Bureau of Highway Traffic

Comparison Provides Estimates of Seeing Factor Rating

Seeing factor ratings for several different examples of current practice will facilitate comparisons which the user can make with his own roadway layouts and lighting. Estimates of seeing performance may thus be obtained with maximum simplicity.

Simplifications will be welcomed by everyone, including those who may now find it difficult to interpolate between the minimum footcandle levels now prescribed by American Standard Practice and the seeing effectiveness desired from roadway lighting systems.

Summary

Action by all those interested in increasing the usefulness and value of our motor vehicle transportation system is solicited. As stated at the beginning of this paper, progress depends upon realization of accountability to the people. Some critical and heavily traveled sections of roadway have been and will be properly lighted. This should be done by devoting increased attention to the successful night use of roadways with seeing comfort, for visibility efficiency, and for traffic comfort, traffic convenience and traffic safety.

It is hoped that this paper will aid in delineating the problem of night traffic and seeing evaluation, and its objectives in helping you achieve maximum progress now, and in the immediate future.

Number ratings and comparisons will be increasingly used to show the effectiveness of roadway lighting in producing seeing and traffic benefit. You should start now making your own and group estimates of the benefit provided. Numbers will help!

Real progress within the next year will require concentrated attention and extra effort. However, this is of small consequence considering the importance of objectives and benefits to be gained. The efficiency of night motor vehicle transportation and the public welfare is involved.

NOTICE

The September issue will be the Convention Issue — and will carry a full outline of the program. Publication dates are being advanced, and the September issue should be mailed early in September.

Look for it — and study the program so you will know what you want to hear at San Francisco without fail.

Planning of Access Controlled Highways in the San Diego Metropolitan Area

By Edward M. Hall (Assoc. Mem., ITE)
Transportation Research Director, City of San Diego

This paper was originally presented to the California Engineering Division at the 1955 Governor's Traffic Safety Conference. —EDITOR

THE PROBLEM of developing access controlled highways and the advantages accruing from such facilities are rather easy to summarize. The basic problem of development is money, or the lack of it, and the advantages are safer, more convenient and more economical highway transportation. The extremely difficult compromises that must be made between available funds and the desire for a high standard of design are particularly acute at the local level of city and county.

Recognizing that the standard of design is directly related to the classification, Sub-Committee II of the National Committee on Urban Transportation recommends a functional classification plan of four systems of streets and highways:

Expressway-Freeway System providing for expeditious movement of large volumes of through-traffic between areas and across the city, and not intended to provide land-access service.

Major Arterial System providing for through-traffic movement between areas and across the city and direct access to abutting property, subject to necessary control of entrances, exits and curb use.

Collector Street System providing for traffic movement between major arterials and local streets and direct access to abutting property.

Local Street System providing for direct access to abutting land and for local traffic movements.

The expressway-freeway system may include radial routes, belt-line or circumferential, crosstown and by-pass facilities. The size of the community will influence the types and combinations of these various facilities.

The major arterial system is primarily devoted to the movement of through-traffic and the interconnection of the expressway-freeway system with various sections of the community. The service to adjacent property should be a secondary function of the major arterial system. In many instances the major arterial system must serve as the backbone of the community since freeways or expressways are not contemplated or cannot be financed.

The major arterial and expressway-freeway systems should tie together all major generators and attractors of traffic and should relieve the local street system of as much through movement as possible. These streets and highways should delineate residential neighborhoods and should influence the design of the commercial and industrial area but should not disrupt sound land use development.

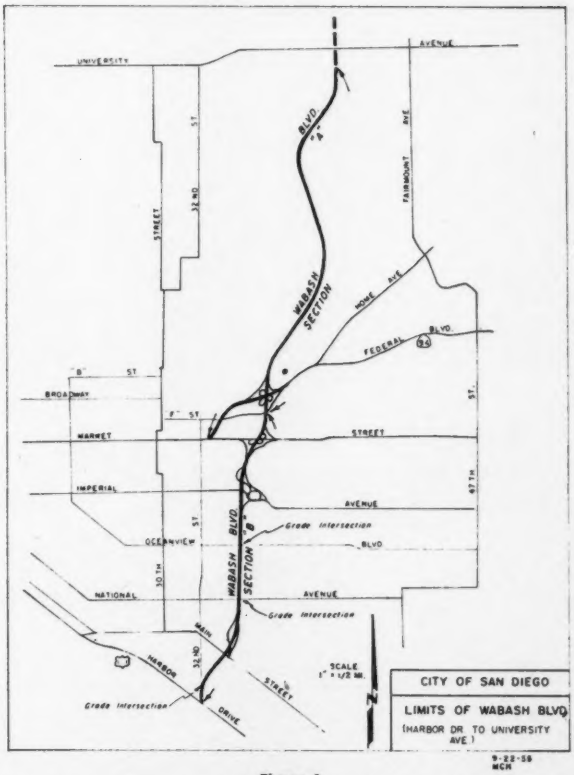

Figure 1
Alignment and Schematic Design of Wabash Boulevard between Harbor Drive and University Avenue in San Diego, California

Sub Committee II strongly suggests that, "Continuity of routes is most important — otherwise, through-traffic movements will be retarded. A properly designated and developed major arterial system should help to define residential neighborhoods, industrial sites and commercial areas, and to minimize conflicts with school and park developments. In order to insure that local and collector streets serve their primary purpose of providing access and local circulation, major arterial streets should not be more than one mile apart."*

The efforts of the San Diego Metropolitan Area to provide its citizens with the safe, convenient and economical service they desire and to apply the principles of transportation planning contained in the Manual of the National Committee of Urban Transportation are perhaps best described in this publication by a three phase system.

*National Committee on Urban Transportation, *How to Get the Basic Facts on Urban Needs and Services*, February 1956, p. VIII-4.

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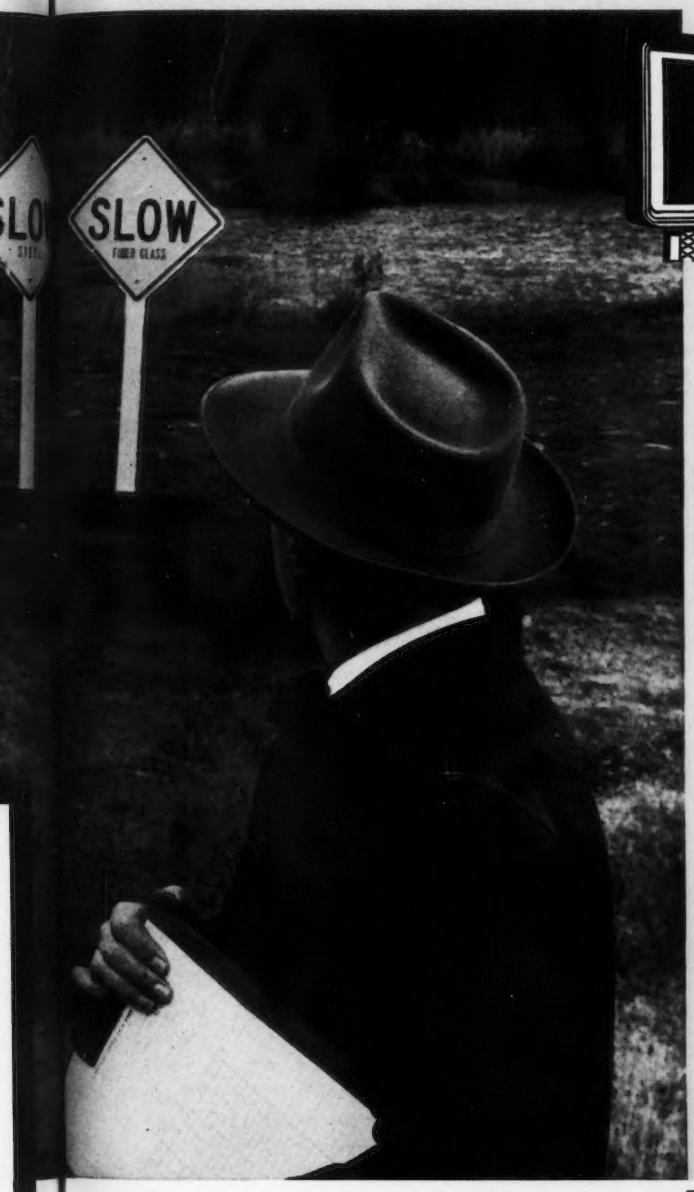

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TABLE I

San Diego Metropolitan Area
CONTROLLED ACCESS FACILITIES
CONSTRUCTED BY LOCAL JURISDICTIONS

Jurisdiction	Facility	Length (miles)	Grade Separations	Signals	Cost		Access Rights Acquired	Volume ADT	Acc. Rate MVM	Date Completed
					Right of Way	Construction				
Joint County-City of San Diego	Mission Valley Rd. (Now U.S. 80)	3.7	0	3	$204,500	$ 792,700	Yes	44,000	1.70	Sept. '51
Joint County-City of San Diego & City of La Mesa	Alvarado Canyon Rd.	5.0	0	1	4,465	757,000	Yes, except thru State College	25,000	1.51	Jan. '50
City of San Diego	Wabash Blvd. Section A	3.2	1	0	741,000	895,000	Abutting Property	11,800	2.18	Aug. '51
	Section B	2.1	3	3		2,273,000	Yes	12,900	6.66*	Dec. '54
County of San Diego	University Ave.**	1.6	0	2	31,800	285,000	No	13,000	3.36	Nov. '54

* Rate excluding grade intersection accidents is 2.22

** University Avenue in this area is included in the existing Limited Access Portion of the Major Street and Highway Plan, but was not reconstructed to Limited Access standards.

Phase 1 — What has been done

Table I lists the controlled access facilities that have been constructed by San Diego City and County.

The Mission Valley — Alvarado Canyon Road is a wonderful example of cooperation between various jurisdictions as the route involved County of San Diego, City of San Diego, City of La Mesa, State matching and F.A.S. funds. This facility was designed and constructed under the direction of Mr. J. H. Mack, San Diego County Surveyor and Road Commissioner. The high volumes and low accident rates indicate the service and safety being rendered. This route is now a part of the State Highway System and existing plans of the California Division of Highways call for its development to full freeway status.

Wabash Boulevard has been designed and constructed under the direction of Capt. A. K. Fogg, City Engineer of San Diego, and is a full freeway except for three signalized intersections at grade. Figure 1 shows the alignment and schematic design of Wabash Boulevard. Plans call for the extension of this facility northerly to join U. S. Highway 80, Mission Valley Road. The accident rate of Wabash Boulevard along the freeway section is one third the accident rate resulting from the inclusion of the grade intersection accidents. This surely again emphasizes the safety benefits of full freeway standards.

The reconstruction of University Avenue from a narrow two-lane road to a four-lane divided major street through a well developed area is of interest in this discussion of controlled access highways because of one important policy that was formulated during its design. Old University Avenue was generally wthout curbs while the new design included curbs. The problem was the location, size and percentage of the property frontage to provide for commercial driveways in the plans of the new facility.

A "Design Standards for Commercial Driveways" was developed and field tested along University Avenue and adopted as the Road Department Policy. This policy provides for a maximum width of 35 feet, 18 feet between driveways, 60% (or 70% if less than 100 feet) of the frontage to be allocated to driveways, and for standards at intersections.

In a sense the access along University Avenue was controlled by the "Design Standards for Commercial Driveways" and by the median. A design policy on encroachment permits can add materially to safety on county roads and city streets.

Phase 2 — What is being done

Table II contains a list of the controlled access facilities that have been recently completed or are now under construction in the San Diego Metropolitan Area.

The extension of the Alvarado Canyon Road from U. S. Highway 80 to State Highway 67 will eliminate a hazardous two-lane road and will serve rapidly growing areas of San Diego City and County as well as the cities of La Mesa and El Cajon. This will be a four-lane divided facility with limited access except through the developed areas of Fletcher Hills. The first portion of this road is now completed and the second portion is now under construction.

The City of La Mesa has completed a continuation of the County development along University Avenue. This improvement is interesting because it is an example of interjurisdictional cooperation and planning and further because the City of La Mesa voted a bond issue to finance its reconstruction.

Phase 3 — What is being planned

We are indeed fortunate in the San Diego Metropolitan Area in that we have had in existence for some time good major street and highway plans adopted by the County Board of Supervisors and the City Council of San Diego. Further, much work is being done by the other cities of the Metro-

TABLE II

San Diego Metropolitan Area

CONTROLLED ACCESS FACILITIES RECENTLY COMPLETED OR UNDER CONSTRUCTION BY LOCAL JURISDICTIONS

Jurisdiction	Facility	Length (miles)	Separations	Signals	Cost Estimates: Right of Way	Cost Estimates: Construction	Access Rights Acquired	Estimated ADT
County of San Diego	Extension of Alvarado Canyon Rd. U.S. 80—Fletcher Hills	3.5	1	0	$105,000	$610,000	In Part	9,350
	Fletcher Hills—67	2.0	0	1	85,000	560,000	In Part	7,500
City of La Mesa	University Ave.*	1.4	0	1	104,000	417,600	No	10,000
City of San Diego	Balboa Avenue	1.1	0	3	52,190	310,000	In Part	14,000

* University Avenue is included in the existing limited access portion of the Major Street and Highway Plan, but is not being reconstructed to limited access standards.

TABLE III

San Diego Metropolitan Area Transportation Study

STREET MILEAGES

As determined from 1950 Modified Plan of Major Streets and Highways

JURISDICTION	POPULATION 1952-53 Special Census	EXPRESSWAY-FREEWAY SYSTEM: Miles of Local	Miles of State	Total Miles	% of Miles	Nat'l. * Comm. Recm. %	MAJOR ARTERIAL SYSTEM: Miles	% of Total	Nat'l. * Comm. Recm. %	COLLECTOR & LOCAL STREET SYSTEM **: Miles	%	Nat'l. * Comm. Recm. %	TOTAL: Miles	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Coronado	17,171	0	0	0	0		11.3	29.5	25-35	27.3	70.5	75-65	38.6	100
Chula Vista	25,864	0	2.3	2.3	3.6		12.9	20.0	20-30	49.3	76.4	80-70	64.5	100
El Cajon	11,097	0	5.0	5.0	10.2		6.6	13.5	25-35	37.4	76.3	75-65	49.0	100
La Mesa	16,249	2.4	2.9	5.3	8.9		7.0	11.8	25-35	47.1	79.3	75-65	59.4	100
National City	26,832	0	2.1	2.1	3.3		16.1	25.4	20-30	45.2	71.3	80-70	63.4	100
San Diego	434,924	52.2	40.4	92.6	10.0		241.1	26.1	20-25	590.2	63.9	80-75	923.9	100
County	101,162***	29.2	31.8	61.0	11.2		156.5	28.6	20-30	328.9	60.2	80-70	546.4	100
Totals	633,299	83.8	84.5	168.3	9.6	5-8	451.5	25.9	20-25	1125.4	64.5	75-67	1745.2	100

* Suggested by Section VIII, National Committee on Urban Transportation Manual, p. 10.

** 1952 Local Street Mileage

*** Per "Sewerage Survey Report", Bay Area (Cordon Area) Pop. = 85% of the total County Population.

politan Area to develop and adopt major street and highway plans. Table III is a breakdown of the street mileages by classification for all the jurisdictions within the San Diego Metropolitan Area. Also included in Table III are the recommendations of the National Committee on Urban Transportation concerning the percent of the total mileage that each type system should comprise.

In an effort to assist in the solution of the many existing transportation problems and to develop the city function of urban transportation planning, the City of San Diego initiated a Metropolitan Area Transportation Study in March of 1955.

The basic components of this Transportation Study include:

A. Physical and operational inventory.

B. Appraisal of current needs.

C. Appraisal of future needs.

D. Appraisal of the economic aspects of street transportation.

E. Developing an urban transportation plan.

F. Programing the plan.

G. Financing the plan.

H. Administration and management of transportation.

I. Legislation for urban transportation.

J. Continuing inventories of the urban transportation planning function.

K. Implementation of the urban transportation plan and program through public information, education and support.

The basic components of the Transportation Study will have in common one effort and that is to establish the

function of transportation planning on a continuing basis commensurate with the needs and growing importance of the movement of people and goods. The development of the program has been closely integrated with the work of the National Committee on Urban Transportation and its nine Sub-Committees, and in March of 1956 San Diego was selected as one of seven pilot cities.

Because the major street and highway plans serve as the heart of our Study, our first project to get underway was the review of the existing street and highway plans. We feel justified in reviewing the excellent existing plans because we now have recent origin and destination data, recent aerial topographic maps on a scale of $1'' = 200'$, and because certain of the adopted state highway freeway routes do not agree with the routes indicated on the major street and highway plans. Further, such a plan is a guide which requires continual review and revision as conditions change and should be thought of as a living plan.

The method selected for this project was the development of an Advance Transportation Planning Team with departmental representatives from Highway Design, Traffic Engineering and City Planning. This Team is now in operation, is in one office and is completely divorced from operations, complaints and irate telephones. It is our hope that we will shortly have a representative of the County Surveyor and the County Planning Department on the Metropolitan Area Advance Transportation Planning Team. The expected benefits of this approach are integrated planning through an appreciation of the other departments' views and problems, and the elimination of the day to day pressure of operations that tend to interrupt or destroy the advance planning function.

In addition to this Advance Transportation Planning Team there is now in operation a Technical Coordinating Committee composed of engineering and planning Department and Division Heads from the Cities of San Diego, Coronado, Chula Vista, El Cajon, La Mesa and National City, County of San Diego and State Division of Highways, as well as the San Diego Transit System and the U. S. Navy. This Technical Coordinating Committee, as its name implies, serves to coordinate and to formulate policies and decisions relative to transportation planning, and to make recommendations to the legislative bodies. I should also mention that it is our intent that the Advance Transportation Planning Team will serve to integrate into the Transportation Plan all the various separate projects which will compose our Study and that the Advance Transportation Planning Team will prepare data, maps and reports for the consideration of the Technical Coordinating Committee.

One very practical use of the Advance Transportation Planning Team and the Technical Coordinating Committee has been initiated. This function is the review of the freeway agreements and their important interrelated effects upon all phases of transportation planning. We are able to report that already there have been beneficial, mutual exchanges of ideas with the ultimate resultant improvement in transportation services.

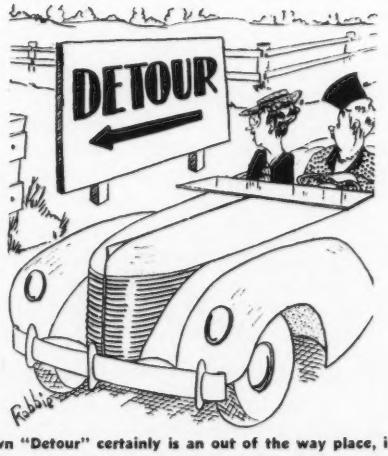
Right of way and the acquisition of access rights present considerable difficulties in the development of controlled access facilities. The City of San Diego has appropriated close to $1,000,000 this year for the advance acquisition of right of way and the County of San Diego has established a revolving fund of $200,000 for the advance acquisition of right-of-way of major streets and highways in the Plan of the County.

One of the unsolved problems, at least unsolved locally, is the legal ramifications of the securing of access rights. This is a particularly difficult question where existing streets are physical closed by local limited access facilities. Apparently the legal background on this matter is not deep enough for clear-cut decisions. This may well become one of the top problems for local jurisdictions before it is ultimately solved.

The development of limited access facilities in the San Diego Metropolitan Area is facilitated by one peculiarity of the topography. The canyons of San Diego tend to make limited access facilities out of portions of major streets and highways, which are not included in the limited access system. Washington Street, Balboa Avenue and Waring Road are examples of four-lane facilities of this type. Further, in certain cases, access rights are acquired for the purpose of traffic control, although the facility is not in the limited access system.

Our City Planning Department has been quite successful in the acquisition of rights of way and access rights from subdividers. By following the major street and highway plans the Planning Department is able to intelligently acquire these rights of way. As a further aid in this effort, the Highway Design Representative on the Advance Transportation Planning Team is placing on standard sheets a preliminary geometric design including the required right of way and preliminary cost estimates of each facility of the major street and highway system of the City of San Diego. We plan that these standard sheets will be available for the use of various departments and jurisdictions to insure that subdividers and all other interested persons and agencies will get the same story at all offices. Ultimately these standard sheets will include much basic data in addition to the geometric design, right of way and cost estimates and will be the backbone of street and highway planning, evaluation and programing.

It is our hope that the Transportation Study in San Diego will establish the continuing function of urban transportation planning through the orderly, uniform collection of data so necessary for the proper planning and programing of access controlled facilities and all phases of transportation.



The town "Detour" certainly is an out of the way place, isn't it?

Dallas-Fort Worth Turnpike Toll Collections

By D. E. Harper
Howard, Needles, Tammen & Bergendoff, Consulting Engineers

INTENSE BUT FRIENDLY rivalry that has existed between the neighboring Texas cities of Dallas and Fort Worth should soon be diminished with the completion of construction of a most modern express highway, the Dallas-Fort Worth Turnpike. The turnpike will directly interconnect the central expressway systems of both cities in effect knitting both, together with the rapidly growing communities of Grand Prairie and Arlington, into one integrated metropolitan area. It is expected that the Turnpike will be open to traffic by July 1957.

The Turnpike will provide approximately 30 miles of limited access 6-lane divided expressway with no intersections at grade (see figure 1). It has been designed to the highest standards and will permit safe and comfortable driving at speeds in excess of 70 miles per hour.

Actual savings in mileage with the new facility between the downtown districts of Dallas and Forth Worth will be small but savings in driving time over traveling present roads will make the new route most attractive. The principal present route, U.S. 80, is virtually a crowded city street and has 38 stop lights along its length to frustrate the through traveler.

Construction of the Turnpike has been financed by the sale of $58,500,000 of bonds. These bonds will be retired from the revenues of the Turnpike received principally through the collection of tolls.

Financing of highway construction by collection of tolls is certainly not a new procedure in the United States. Records are not complete but it is believed that well over 8,000 miles of toll highways were in operation in the early 19th century. The Philadelphia and Lancaster Turnpike, one of the earliest to be built, was completed in 1796 at a total cost of $465,000. This turnpike had 13 toll stations along its 62-mile length. Most toll stations on these early highways utilized a swinging semaphore type gate to detain the patron until his toll could be collected. No equipment was available to gauge the efficiency of the toll collectors so the financial security of the operation rested largely in their hands.

All these early, privately owned toll roads eventually fell into disuse for various reasons. Undoubtedly, the growth and development of paralleling railroads and canals were partially responsible for the failure of many of the early turnpike companies, but it is known that their troubles were greatly aggravated by lack of revenues necessary to perform proper maintenance. The poor condition of these ill-maintained facilities caused them to become increasingly less attractive for travel. Quite possibly, lack of control over the toll collection operation contributed in large measure to a deficiency in revenue. Modern, publicly administered toll highways must and do have better regulation of their operations. Equipment and procedures have been developed to provide the necessary safeguards of revenue.

The Dallas-Fort Worth Turnpike will have 6 toll stations. The end stations will be of the "barrier" type extending across the main roadways (see figure 2). Intermediate stations will be located across access ramps to the main roadways in "trumpet" type interchanges. These trumpet toll stations will permit uninterrupted travel of through vehicles after their initial stops at the entrance station (see figure 3).

The toll collection procedure is complicated by the necessity of applying the equitable principle of charging tolls that are proportional to the benefits received by each vehicle traveling the turnpike. Vehicles are separated into classification groups that reflect the use and weight of each vehicle. The number of vehicle axles is the same for all types of vehicles in each regular classification. Typical classifications proposed to be adopted for the Dallas-Forth Worth Turnpike are as follows:

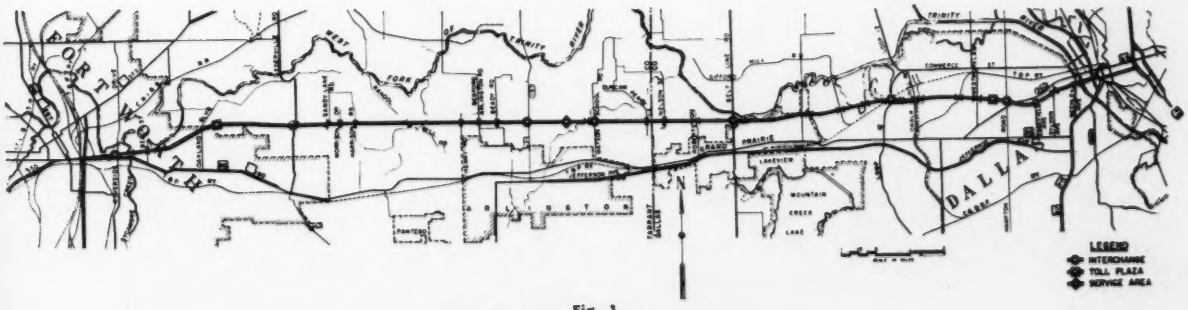


Fig. 1
Route of Dallas-Fort Worth Turnpike.

Class 1 — 2 axle single rear tire trucks, automobiles & motorcycles
Class 2 — 2 axle dual rear tire trucks and busses
Class 3 — 3 axle trucks, busses, tractor-semitrailers, Class 2 vehicles with single axle trailer
Class 4 — 4 axle tractor-semitrailer, Class 2 vehicles with 2 axle trailer, Class 3 with single axle trailer
Class 5 — 5 axle tractor-semitrailer, other vehicle combinations with 5 axles
Class 6 — Class 1 vehicles with single axle trailer
Class 7 — Class 1 vehicles with 2 axle trailer
Class 8 — Special vehicles

Toll rates will differ for each of these classifications and will be assessed in proportion to the distance traveled by the vehicle on the Turnpike. Passenger automobiles will be permitted to reverse their direction of travel at the restaurant centrally located on the Turnpike. No other "U" turns will be permitted. To encourage usage of the facility, the operators of commercial vehicles will be permitted to establish charge accounts. Maintenance and other vehicles of the Turnpike management in performance of official duties will travel the Turnpike without charge. It may be seen that strict accounting for each of the 11,000,000 vehicle transactions of various types anticipated in the first year of operation will present a formidable task.

The system of toll collection will be based on the use of tickets of the punched-card type that will be processed with standard punched-card accounting machines. At his point of entry on the Turnpike, the motorist will be handed a ticket by the entrance attendant. The motorist will proceed to his point of exit and there be charged the fare indicated on the ticket. Tickets collected at the exit will be forwarded to a central accounting office and processed to obtain traffic and revenue statistics and an audit of the toll collectors' operations.

Considerable equipment is required to maintain collection control at the toll station. The principal units are a toll register located in the toll booth, a traffic treadle in the toll lane pavement, and a remote recorder in the adjacent utility building.

The entrance toll register will have a pushbutton for each of the vehicle classifications. After a toll ticket is placed in the register, depression of the appropriate push button will cause the ticket to be printed and punched with identifying data and cause transmission of a record of the number of vehicle axles corresponding to the particular vehicle classification to the remote recorder.

The exit register will automatically cancel the ticket by printing and punching identifying data and cause a record of the number of vehicle axles as code punched on the ticket at the entrance to be transmittted to the remote recorder. A receipt printer, operated in conjunction with the exit register, will provide a receipt for any type cash or charge transaction if the patron requests.

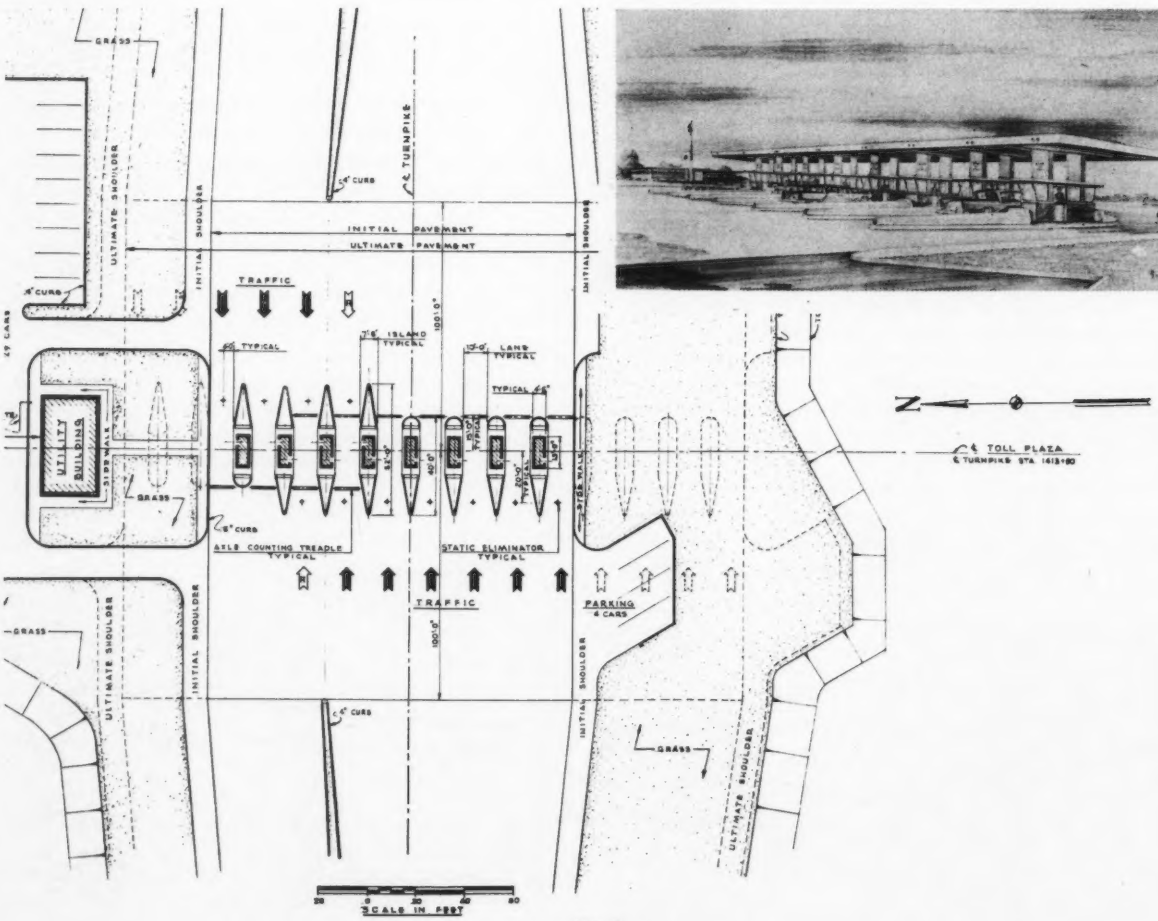


Fig. 2
Dallas Terminal-Barrier toll station.

Forward and reverse movements of vehicles through a toll lane will be detected by the traffic treadle in that lane. The treadle is a rubber mat with inner electrical contacts that are closed sequentially only by the rolling motion of a vehicle wheel. This action transmits a record of each axle crossing the treadle to the remote recorder.

Remote recorders will be located in a locked room in the utility building at each toll plaza. They will receive counts from the registers and traffic treadles, recording these on paper tapes. The paper tapes will provide a record, there is no basis on which the collector may attempt to manipulate his register operation fraudently if there should be a temporary treadle skip or failure. He must assume that the treadle is properly recording all vehicle axles and conduct his operations accordingly.

A restaurant and service station area will be located midway on the Turnpike. The equipment to maintain control of passenger vehicle "U" turns at this area is unique with the Dallas-Fort Worth Turnpike. It will consist of four units: a ticket validator, traffic signal lights, token signal controls and signal treadles. All vehicles desiring to "U" turn must pass through special turnaround lanes. These lanes will have a traffic signal light that is connected with the token signal control. The motorist must pass this control before reaching the signal light and a signal treadle in the lane pavement. He will cross the treadle after he has passed the signal light. A patron desiring to turn around will present his regular toll ticket to the restaurant cashier or service station attendant for special validation in the ticket validator. This special validation will indicate to the exit toll collector that the patron has passed through the restaurant turnaround. The toll ticket is returned to the patron together with a small metal token. He proceeds, in his automobile, to the turnaround lane and observes the red traffic signal requiring that he stop. After placing the token in the token signal control, causing the red signal to change to green, the patron will proceed through the turnaround lane. As the first axle of his automobile crosses the signal treadle it will cause the traffic signal to return to red to stop the next oncoming vehicle. Failure to stop on the red signal will be a traffic code violation and will make the motorist subject to police action.

The procedures for handling charge and non-revenue transactions will be simplified by a charge plate system that is to be used on the Turnpike. An account number will be assigned to each charge and non-revenue patron. Each such patron will be issued a small, permanent, plastic charge plate that has been code punched with the account number and other identifying information. The plate will also be printed with identifying data to prevent its use with other than a specific vehicle if the patron requests. As the charge patron enters the Turnpike, he will be issued a toll ticket in the usual manner, and will proceed to the exit station, there presenting the ticket together with the charge plate to the exit collector. The collector will place the ticket in his register together with the charge plate, causing the account number to be punch reproduced in the ticket. The account number punching in the ticket will enable the tickets to be readily segregated in the central offices for accounting and automatic billing.

The toll collection system is designed to prevent or detect, insofar as practicable, any fraudulent practice on

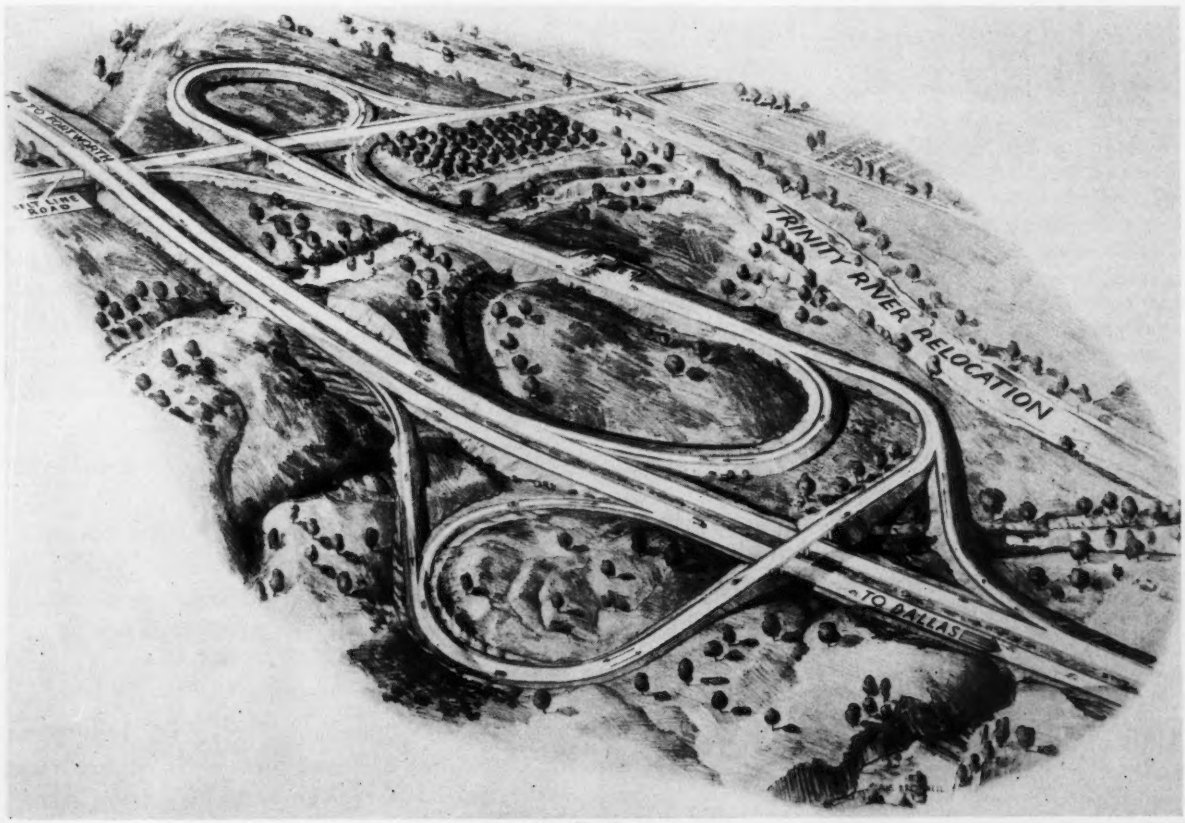


Fig. 3
Trumpet interchange toll station.

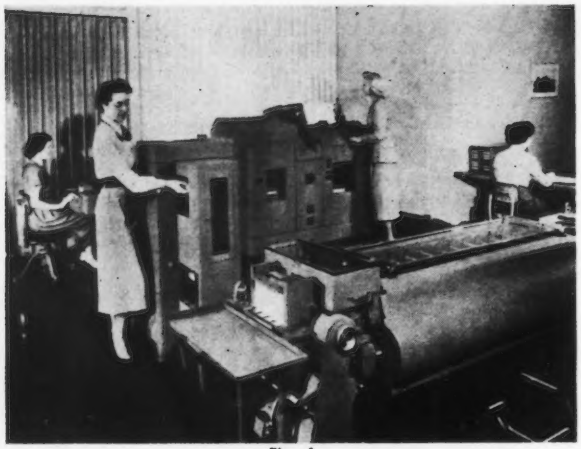


Fig. 4
Toll accounting operation.

the part of either a collector or turnpike patron. Among the many frauds sometimes attempted is one commonly termed "kiting". As an illustration, assume that a turnpike has six toll stations — A, B, C, D, E and F. It is the usual practice to charge a patron the fare from the most distant station if he arrives at an exit station and reports that he has lost his ticket. Assume that a regular commuter, one morning, enters the turnpike at Station A. He is issued a ticket and proceeds to an exit at Station F. There he reports, falsely, that he has lost his ticket and is charged at no penalty the fare from the most distant Station A. That evening, he enters the turnpike at Station F, is issued a ticket, and proceeds toward Station A, but leaves the turnpike instead at Station B. At Station B he presents the ticket issued that morning at Station A and is charged only the fare for the short trip between Stations A and B. As he now has the unused ticket issued at Station F in his posesssion, he may repeat this "kiting" cycle indefinitely. If the collector at Station B had the time available to analyze the entering time printed on the ticket, he would observe that the short trip had apparently taken several hours more driving time than normal. On the Dallas-Fort Worth Turnpike this detection of excess time will be automatically signaled by the exit toll registers. These registers will sense and read entrance time holes punched in the toll tickets. If excess time is detected, the exit register will light a warning light and cause a distinctive punch mark to be made in the ticket, alerting the collector so that he may take appropriate action with the errant motorist.

As another example of fraudulent practice, it would undoubtedly occur to an exit toll collector that he might destroy an occasional toll ticket without validating it and pocket the fare represented by that ticket. This dereliction would be readily disclosed by the toll audit, in comparison of axles indicated by the tickets with axles recorded from the treadle.

Control of issuance of extra validated tickets by the entrance collector is maintained in a similar manner. The record of vehicle axles passing over the treadle must check with the record of axles as punched into the validated tickets or fraud be suspected. Extra validated tickets might be used fraudulently in several ways. As an example, a collector at Station A might transmit several extra validated tickets to an accomplice exit collector at Station B. The exit collector could substitute these extra tickets, ostensibly for the short trip from A to B, for longer trip tickets of the same class from Station F and pocket the difference in tolls.

These are but a few of the many possible frauds that might be practiced if means and procedures had not been developed for their control. Known variations to these petty frauds are numerous, and undoubtedly ingenious toll collectors in the future will discover new ways to commit an occasional fraud for which countermeasures have not yet been developed. The toll equipment to be employed on the Dallas-Fort Worth Turnpike is the result of many years study and collaboration by engineers, equipment manufacturers and turnpike authorities, and is of the type used on most recent major turnpikes.

The ticket system of toll collection to be employed on the heavily traveled Dallas-Fort Worth Turnpike would be a practical impossibility without high speed business machinery to process the great number of tickets. Traffic engineers have estimated that the equipment must handle 11,000,000 transactions in the first year of turnpike operation, and by the fifth year must handle 14,000,000. During an average week in the fifth year, 270,000 tickets will need to be processed, and a great many more during certain peak weeks of the year. The system has been designed for the fifth year of operation to provide all required statistics and report data for the anticipated peak week ticket collection in a maximum of 24 work hours following that week. A comparatively small staff of six machine operators with one supervisor, working a normal 40 hour week. is expected to be adequate to meet all requirements (see figure 4).

Details of the processing procedure are somewhat complex but it briefly involves:

1. Sorting and counting each toll collector's ticket collection with respect to classification and entry station.

2. Assembly of data from the remote recorders corresponding to the ticket collection being analyzed.

3. Toll audit, constituting comparison of data from the ticket collection, the remote recorder tape and the collector's cash and charge receipts.

4. Calculation and accumulation of all data concerning mileage, origin and destination, traffic, revenue, classification and other required information.

5. Periodically assembling all statistics into daily, weekly, monthly and annual reports as desired.

The billing operation for charge accounts will be almost completely automatic. Charge toll tickets will be sorted by account number and tabulated periodically to produce invoices bearing the customer's name and address with separate daily listings of trips, mileage, vehicle class, toll charges, entrance and exit stations.

All audit and accounting operations will be performed in a central office building located within the interchange near Arlington, Texas. This building will also provide offices for all other functions of the Turnpike management.

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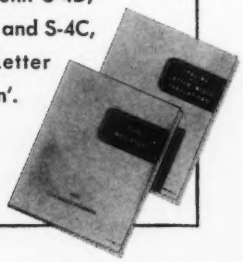

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Traffic News

Digest of Federal-Aid Highway and Highway Revenue Acts of 1956

The new law (Public Law 627) provides for a 13-year program for the Interstate System and a three-year program for the regular Federal-aid highway systems. Authorized Federal expenditures for these periods amount to $27.839 billion. (Federal funds for Interstate System — $25 billion; Federal funds for regular systems—$2.550 billion; Federal funds for public domain roads — $289 million; state matching funds for Interstate and regular systems —$5.301 billion. Thus, the total program amounts to $33.140 billion, including authorizations for fiscal year 1957 provided by the 1954 Federal-aid Highway Act.)

Interstate System Funds — Sec. 108 authorizes a $24.825 billion Federal expenditure on the Interstate System over a 13-year period, from 1957 to 1969. Allocations for this system are provided as follows:

Fiscal Year	Authorization	Fiscal Year	Authorization
1957	$1,000,000,000 *	1964	$ 2,200,000,000
1958	1,700,000,000	1965	2,200,000,000
1959	2,000,000,000	1966	2,200,000,000
1960	2,200,000,000	1967	2,200,000,000
1961	2,200,000,000	1968	1,500,000,000
1962	2,200,000,000	1969	1,025,000,000
1963	2,200,000,000		
			$24,825,000,000

* In addition to the $175 million already authorized for 1957.

These funds are made available to the states on the basis of the states putting up 10 per cent and the Federal Government 90 per cent of the cost of any project. The existing sliding scale for public lands states is retained with a maximum Federal contribution of 95 per cent.

Apportionment among the states for the first three years of the 13-year program is authorized on the basis of the present formula, which gives two-thirds weight to a state's population, one-sixth to its area, and one-sixth to its rural road mileage. Apportionments for 1960 and succeeding years shall be made on the basis of further study and revised estimates of completion costs submitted in January 1958, 1962, 1966, 1967, 1968 and upon affirmative approval of the Congress.

States are authorized to accelerate work on the Interstate System, over and above that which can be accomplished with apportioned funds, by using their own funds. The Federal share of the cost of any such projects would be reimbursed to the state from apportionments in a later year.

The mileage of the Interstate System is increased from 40,000 miles to 41,000 miles. The additional 1,000 miles shall be excluded in making estimates of cost for completion of the Interstate System.

The name of the Interstate System is changed to the "National System of Interstate and Defense Highways."

The geometric and construction standards for the Interstate System shall be adequate to accommodate the types and volumes of traffic forecast for the year 1975.

Primary and Secondary System Funds — Sec. 102 authorizes the following funds for the primary and secondary systems and extensions to these systems within urban areas for fiscal years 1957, 1958 and 1959. The 1957 authorization is in addition to the $700 million already authorized.

	FISCAL YEARS		
	1957 (Additional)	1958	1959
System			
Federal-aid primary	$ 56,250,000	$382,500,000	$393,750,000
Federal-aid secondary	37,500,000	255,000,000	262,500,000
Extensions within urban areas	31,250,000	212,500,000	218,750,000
TOTAL	$125,000,000	$850,000,000	$875,000,000

States are authorized to transfer up to 20 per cent (now 10 per cent) of their apportionment under the primary, secondary and urban funds from one system to either of the other two systems, except that the apportionment for any system shall not be increased by more

(Continued on page 506)

Traffic Engineering Awards Made By Institute

Eight states and twenty-four cities have been cited by the Institute of Traffic Engineers for traffic engineering achievement in 1955.

The awards are based on performance as reported in the Annual Inventory of Traffic Safety Activities, conducted by the National Safety Council. Cities judged to have achieved a performance level of 85 per cent or better and states 90 per cent or better were awarded certificates of achievement.

The judges for the Institute's awards were: D. Grant Mickle, director of traffic engineering division, Automotive Safety Foundation; Fred Burggraf, director, Highwal Research Board; E. H. Holmes, deputy commissioner, U. S. Bureau of Public Roads; B. W. Marsh, director of traffic engineering and safety, American Automobile Association, all of Washington; M. A. Kraft, director of personnel and accident prevention, American Transit Association, New York City; and Harry Porter, Jr., director of traffic inventory, National Safety Council, Chicago.

The winning cities and states, which will be presented the awards in local ceremonies, are listed below:

States

California	Michigan
Connecticut	Oregon
Delaware	Virginia
Massachusetts	Washington

Cities

Baltimore, Md.	Los Angeles, Calif.
Charlotte, N.C.	Madison, Wisc.
Chicago, Ill.	Milwaukee, Wisc.
Cincinnati, Ohio	Pasadena, Calif.
Cleveland, Ohio	Phoenix, Ariz.
Denver, Colo.	Pittsburgh, Penna.
Detroit, Mich.	Portland, Ore.
Grand Rapids, Mich.	Rochester, N.Y.
Hammond, Ind.	Seattle, Wash.
Highland Pk., Mich.	Two Rivers, Wisc.
Hutchinson, Kansas	WallaWalla, Wash.
Indianapolis, Ind.	Wausau, Wisc.

(Continued from page 505)

than 20 per cent by reason of such transfers.

Alaska Included — Sec. 107 authorizes the Territory of Alaska, for the first time, to share in funds for the primary and secondary systems and extensions thereto within urban areas. Only one-third of the area of Alaska shall be used in the calculations to determine the basis of apportionment of such funds. The Territory is required to contribute in an amount of at least 10 per cent of the Federal funds apportioned to it. Such funds may be expended for maintenance as well as construction.

The functions heretofore delegated to the Secretary of the Interior, with regard to road building in Alaska and all personnel involved, are transferred to the Secretary of Commerce.

Public Domain Roads — Secs. 103, 104 and 105 authorize funds as follows:

	FISCAL YEARS		
	1957 (Additional)	1958	1959
Forest Highways		$ 30,000,000	$ 30,000,000
Forest Development Roads and Trails		27,000,000	27,000,000
Park Roads		16,000,000	16,000,000
Parkways		16,000,000	16,000,000
Indian Roads		12,000,000	12,000,000
Public Lands Highways	$2,000,000	2,000,000	2,000,000
	$2,000,000	$103,000,000	$103,000,000

Emergency Highway Fund—Sec. 118 increases the fund from $10 million to $30 million for repair or reconstruction of highways on the Federal-aid systems which are damaged as a result of disaster.

Sizes and Weights—Sec. 108 (j) prohibits apportionment of funds for the Interstate System to any state that permits lawful use of the system by vehicles having weights or dimensions in excess of the greater of (1) 18,000 lbs. on a single axle, 32,000 lbs. on tandem axles, 73,280 lbs. gross weight, 96 inches in width, or (2) the corresponding maximum weights or widths permitted by state laws or regulations in effect on July 1, 1956. The Secretary of Commerce is directed to expedite a series of tests now planned or being conducted by the Highway Research Board on maximum desirable dimensions and weights and to report findings and recommendations to Congress not later than March 1, 1959.

Right-of-Way Acquisition—Sec. 109 authorizes the Secretary of Commerce to acquire lands or interests in lands, including control of access, if the state is unable to do so or cannot do so with sufficient promptness, and the state requests such acquisition. Such lands would be conveyed to the state, except the outside five feet in any state which does not provide control of access. Whenever a state makes satisfactory provision for control of access, the outside five feet shall be conveyed.

Advance Right-of-Way Acquisition—Sec. 110 provides that funds apportioned to the states may be made available upon request for expeditious right-of-way acquisition. Roads are to be constructed within a five-year period following the fiscal year in which a state makes such request.

Control of Access—Sec. 112 requires agreements between the Secretary of Commerce and the state for construction of projects on the Interstate System to contain a clause that all points of access to or exit from an Interstate System project shall be approved by the Secretary. Agreements shall also contain a clause prohibiting commercial establishments on the right-of-way. Such agreements may authorize a state or political subdivision to use the air space above and below the highway for parking if it does not interfere with the free flow of traffic.

Utility Relocation Costs — Sec. 111 provides that whenever a state (as required by state law and regulation) shall pay for the cost of relocation of utility facilities necessitated by construction of projects on any Federal-aid system, Federal funds may be used to reimburse the state for such cost in the same proportion as Federal funds are expended on the project.

Reimbursement Study—Sec. 114 declares the intent and policy of Congress to determine if states should be equitably reimbursed for roads on the Interstate System, whether toll or free, that meet required standards and have been completed subsequent to August 2, 1947 and are in actual use or under construction by contract awarded not later than June 30, 1957.

The Secretary of Commerce is directed to make a study to determine which highways in the Interstate System measure up to required standards, their cost and depreciation and submit a complete report to Congress in January, 1958. The time, method and amounts of such reimbursement, if any, shall be determined by Congress after receipt of the study.

Toll Roads, Bridges and Tunnels — Sec. 113 provides that any toll road, bridge or tunnel located on the Interstate System may be approved as part of the system if it meets the required standards and would promote the development of an integrated system. No Federal-aid highway funds shall be expended on any toll road, except in certain cases on approach roads.

Highway Safety Study—Sec. 117 directs the Secretary of Commerce to make a full and complete study to determine what action can be taken by the Federal Government to promote the public welfare by increasing highway safety. The study shall consider:

(1) The need for Federal assistance in enforcement of highway safety and speed requirements;

(2) The advisability of and the steps necessary to promote the adoption of uniform laws;

(3) Promotion of highway safety in the manufacture of vehicles;

(4) Highway safety educational programs;

(5) The design and physical characteristics of highways, and

(6) Other appropriate matters.

Prevailing Wages—Sec. 115 requires all laborers and mechanics employed on the initial construction work performed on highway projects on the Interstate System to be paid wages at rates not less than those prevailing on the same type of work on similar construction in the immediate locality in accordance with the Davis-Bacon Act.

The Secretary of Labor is required to consult with each state highway department and make a predetermination of minimum wages to be paid laborers and mechanics.

Progress Reports—Sec. 116 declares it to be in the national interest to accelerate the construction of the Federal-aid highway systems and complete the Interstate System to standards adequate to

meet the needs of national and civil defense and local and interstate commerce. The Secretary of Commerce is directed to report to the Congress by February 1, 1959 on progress toward this objective, along with recommendations.

Other Provisions—Sec. 119 redefines the term "construction" to include the cost of geodetic markers. Sec. 120 authorizes funds to be used for archeological and paleontological salvage. Sec. 121 authorizes the use of photogrammetric mapping and utilization of commercial enterprises for such services.

Sec. 116 (d) provides that the Secretary of Commerce should assist, insofar as feasible, small business enterprises in obtaining contracts in connection with the prosecution of the highway program.

Title II

(Highway Revenue Act of 1956)

Title II of the law creates a special highway trust fund into which would be placed approximately $38.5 billion from certain new and existing highway user tax revenues over a 16-year period.

	Excise Tax Increases		Est. 16-yr. yield from increases
	Present Rates	New Rates	(In Millions)
Gasoline	2c per gal.	3c per gal.	$ 9,295
Diesel Fuel (and special motor fuel)	2c per gal.	3c per gal.	251
Tires	5c per lb.	8c per lb.	1,909
New Trucks, Buses and	5%	8% (from 7/1/57)	1,356
Truck-Trailers	8%	10% (from 7/1/56)	957
Camelback (New Tax)	— — —	3c per lb.	180
Highway Use Tax on Vehicles over 26,000 lbs. (New Tax)	— — —	$1.50 per 1,000 lbs.	866
Total estimated yield from increases over 16-year period			$14,814
Total estimated yield from present taxes allocated to trust fund			23,684
Total estimated trust fund receipts			$38,498

The increased and additional excise taxes take effect on July 1, 1956 and continue over a 16-year period until July 1, 1972.

Exemptions—The tax increases with respect to gasoline, Diesel fuel and special motor fuels apply only when used in a highway vehicle which is registered or required to be registered, for highway use under the laws of any state or foreign country. The tax increase on tires and tread rubber applies only to the type used on "highway vehicles."

Gasoline Tax Refunds — A refund procedure is provided for the additional one cent gasoline tax where gasoline is used for nonhighway purposes. The procedure is generally the same as that provided for gasoline used on a farm for farming purposes where the ultimate purchaser files annual refund claims.

Refunds are also allowed on the one cent increase in the motor fuel tax when such fuel is used in local transit system vehicles and intercity buses under certain circumstances.

Highway Use Vehicle Tax—A new tax is imposed on the use of any highway motor vehicle which has a taxable gross weight of more than 26,000 pounds, at the rate of $1.50 a year for each 1,000 pounds of taxable gross weight or fraction thereof. This applies to weight below and above 26,000 pounds.

If the vehicle is first used after July 31, the tax shall be prorated from the first day of the month in which such use occurs to the following June 30.

"Highway motor vehicle" is defined as "any motor vehicle which is a highway vehicle."

"Taxable gross weight" is defined as the sum of the actual unloaded weight (vehicle or combination fully equipped for service) and the weight of the maximum load customarily carried on highway motor vehicles of the same type.

Highway motor vehicles used by any state or political subdivision are exempt. U. S. Government vehicles may be permitted an exemption if such tax "will cause substantial burden or expense which can be avoided by granting tax exemption and that full benefit of such exemption, if granted, will accrue to the United States."

"Transit-type buses" (as distinct from intercity buses) would be exempt if they meet the test that at least 60 per cent of the passenger fare revenue for the last three months of the preceding year was attributable to fares exempt from the excise tax on transportation of persons (fare not in excess of 35 cents or commutation fares).

Floor Stocks Taxes—The excise tax increases would apply to floor stocks on trucks, buses and truck-trailers, tires, tread rubber and gasoline held by a dealer for sale on July 1, 1956. Floor stocks refunds are provided for with respect to inventories on hand July 1, 1972. Floor stocks taxes are not to be paid until such time after September 30, 1956, as may be prescribed by regulation.

Highway Trust Fund—A "Highway Trust Fund" is created to which would be transferred amounts equivalent to the following percentages of the taxes received in the Treasury before July 1, 1972:

(a) 100 per cent of the tax revenues received after June 30, 1956 from gasoline, Diesel fuel, special motor fuels, tread rubber, truck and bus use tax and floor stock;

(b) 20 per cent of the tax revenues received after June 30, 1956 and before July 1, 1957 from new trucks, buses and truck-trailers;

(c) 50 per cent of the tax revenues received after June 30, 1957 from new trucks, buses and truck-trailers;

(d) 37½ per cent of the tire tax revenues received after June 30, 1956 and before July 1, 1957;

(e) 100 per cent of the tax revenues received after June 30, 1957 from tires and inner tubes.

The law further declares the policy of Congress to be that, if it appears that total receipts of the Trust Fund will be less than the total expenditures, or that the distribution of the tax burden among the various users or beneficiaries is not equitable, legislation shall be enacted to bring about a balance of receipts and expenditures, or such equitable distribution, as the case may be.

Trust Fund Management—The management of the Trust Fund would be the duty of the Secretary of the Treasury, who would be required to report to the Congress on each March 1, the financial condition and the results of the operations of the Fund during the preceding fiscal year.

The Secretary of the Treasury is required from time to time to estimate

(Continued on page 513)

National Safety Council Objectives

The National Safety Council has taken a look into the future and come up with some disconcerting figures.

By 1966 there will be an endless swarm of 82,000,000 motor vehicles jamming the streets and highways, 20,000,000 more than are on the road now. They will be piloted at various times by 90,000,000 drivers, and travel approximately 825 billion miles a year.

The traffic toll that year will be around 53,000 — unless some genius manages to pull down the prevailing death rate by getting to those 90,000,000 drivers with a safety sales talk that is more convincing than anything thought up so far.

Here is the Council's plan for cutting the toll and congestion of future traffic —based on proven techniques of engineering, education and enforcement.

1. Convince the public that the only real answer to the traffic problem is for every individual not only to drive and walk sensibly and safely himself, but to join actively in an organized community and national effort to see that others do the same. If this means more stringent traffic law enforcement—as it will in many places—demand, support and accept it!

2. Give every community the facts on how its traffic safety program stacks up against recognized standards—and help it bring itself up to or above par. The Council provides the way to do this through its Annual Inventory of Traffic Safety Activities, now being used by 46 states and by 1,140 cities.

3. Build as many miles of safe, modern accident-resistant highways as possible—and as fast as possible. The way they are financed, says the Council, isn't half as important as the fact that unless they're built, this country will have outsmarted itself trafficwise.

4. Along with building new and better and safer roads, use every modern technique of traffic engineering and law enforcement to make existing highways as foolproof and safe as possible.

5. Cut through red tape, apathy and legislative inertia to obtain uniform vehicle laws and do what common sense tells the nation it should have done long ago—give the driver a set of simple, understandable traffic rules and laws that he can follow from coast to coast—and that he can be sure will be enforced.

6. Make driver education — in class and behind the wheel — a required course for every student of driving age in every high school.

7. Make it so tough to get a driver's license that only a person who is physically, mentally and emotionally qualified to drive in modern traffic can get one.

8. Take the license away from any driver as soon as he demonstrates inability to drive as a decent, sensible citizen should drive.

9. Back traffic courts to the limit in showing errant drivers and walkers that it just isn't smart or healthy to behave selfishly or dangerously in traffic.

10. Encourage constant improvement in automobile design to make it easier to drive safely.

Hewes Award Won By Traffic Engineer

For the second year in a row, a traffic engineer and an ITE member has won or shared in the Dr. L. I. Hewes award. Robert C. O'Connell (Junior Member, ITE), Traffic and Planning Engineer of the Wyoming Highway Department, shared the 1956 award of $500 with a resident engineer from Idaho. Last year the award was won by J. Al Head (Member, ITE), Assistant Traffic Engineer of the Oregon State Highway Department.

The award is given annually by James I. Ballard, President of *Western Construction* magazine, to a highway engineer in the West in recognition of outstanding work in the field of highway engineering. O'Connell was nominated on the basis of his traffic engineering activities in Wyoming.

In addition, he has served as advisor to many Wyoming municipalities not in a position to employ a regular city traffic engineer.

He is a graduate of the University of Wyoming and holds a certificate from the Yale Bureau of Highway Traffic. A registered professional engineer, he is a member of the Coordinating Board of the Governor's Safety Committee and the Cheyenne City Planning Committee.

Married, he lives in Cheyenne with his wife, Ruth, and his three daughters, Susan, Kathy and Shellie.

Robert C. O'Connell (center) is congratulated by Robert Byrne of "Western Construction" magazine upon presentation of the 1956 Hewes Award. At the left is E. V. Miller, State Highway Engineer of Idaho, who accepted the award for A. J. Sachse, the other winner.

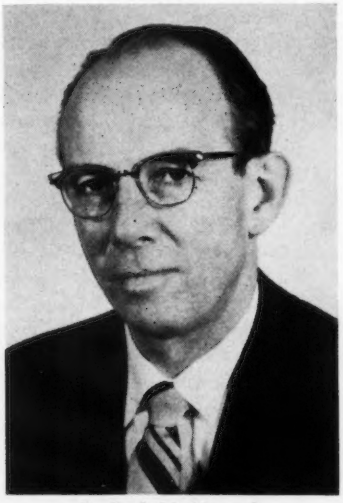
WHEN YOU CHANGE YOUR ADDRESS

. . . . please notify us promptly. Your copies of **"Traffic Engineering"** will then reach you without delay and without interruption. —Traffic Engineering Magazine, 2029 K St. NW, Washington, D.C.

New Appointments

McMonagle Named Professor at Michigan State University

J. Carl McMonagle, (Mem., ITE) for 20 years with the Michigan State Highway department, has been named professor at Michigan State University and



J. Carl McMonagle

assistant director for field services of the Highway Traffic Safety Center.

The State Board of Agriculture, governing body of M.S.U., approved McMonagle's appointment effective August 1, 1956.

Durward B. Varner, M.S.U. vice president, in commenting on the appointment, stated: "McMonagle's long experience with highway traffic problems as director of the planning and traffic division of the State Highway department ideally equips him for the varied responsibilities involved in the field assistance program of the Center.

"This important function of the Center will provide on the spot appraisal of local traffic problems and counsel to official and citizens' groups in Michigan cities and counties."

McMonagle is well acquainted with problems of local traffic safety and administration. His work in this field lead to national recognition by many organizations.

He is vice president of the Institute of Traffic Engineers and has been nominated as president for next year; a member of the Traffic and Transportation Conference of the National Safety Council; and has served on the operating committee of the Michigan State Safety Commission.

He is active in research, serving as chairman of 5 traffic engineering committees of the National Highway Research Board, and is a member of the American Association of State Highway Officials and the American Society of Planning Officials.

Before joining the State Highway de-

(Continued on page 510)

Halsey Joins Eno Foundation

Maxwell N. Halsey (Founder Mem., ITE) was recently appointed Traffic and Safety Advisor on the staff of the Eno Foundation for Highway Traffic Control at Saugatuck, Connecticut.

Maxwell N. Halsey

Previously Mr. Halsey held positions of State Traffic Engineer of Massachusetts, Staff member of the National Bureau of Casualty and Surety Underwriters, Associate Director of the Bureau for Street Traffic Research (now the Yale Bureau of Highway Traffic) and for the last fourteen years served as the Executive Secretary of the Michigan State Safety Commission.

His 30 year career began when he was granted the first graduate fellowship in traffic engineering at Harvard University in 1926 where he obtained his masters degree. He is the author of three books and is presently engaged in preparing a fourth to be published by the Eno Foundation which will deal with the "Driver Control Chain."

Dwight T. Myers Heads Veon Chemical Corp.

The Veon Chemical Corporation of Long Island City, a subsidiary of the Broadway Maintenance Corporation, has recently announced the appointment of Dwight T. Myers (Mem., ITE) as presi-

Dwight T. Myers

dent, following his resignation as deputy commissioner and chief engineer of the New York City Department of Traffic, a post he held from 1953 to June 1, last.

A graduate civil engineer, Mr. Myers has a long record of achievement in traffic engineering. Prior to assuming his New York City post, he was traffic engineer and parking director for the City of Providence, R. I., and special traffic consultant to other New England communities, including New Haven, Conn. and Pawtucket, R. I. He also served as director of the Bureau of Traffic Engineering and Planning in Johnstown, Pa., from 1939 to 1942. During World War II, he saw service as lieutenant in the U S. Naval Reserve, Civil Engineering Corps.

Mr. Myers is a member of many engineering societies, including the National Society of Professional Engineers; the New York Society of Municipal Engineers, and the Institute of Traffic Engineers. He is a contributor to several professional publications.

The new Veon Chemical Corporation president is a graduate of the University of Pittsburgh and Yale University's Graduate School. He resides at 628 E. 20th St., Manhattan.

Humphrey Moves To Indianapolis

H. Dale Humphrey (Assoc. Mem., ITE) formerly with the Bureau of Street Traffic and Parking in Chicago, was recently appointed Senior Assistant Traffic Engineer for Indianapolis, Indiana. He replaces James E. Angell, who has recently moved to Wichita.

A native of Indianapolis, Mr. Humphrey attended Shortridge High School and Butler University there before transferring to Purdue University from which he received a Bachelor of Science Degree in Civil Engineering in 1950.

After a few months employed with the Bureau of Street Traffic in Chicago, Mr. Humphrey entered the U. S. Army and was assigned to the Transportation Corps Research and Development Station at Fort Eustis, Virginia. His work in the Highway Section of TRADS included a Traffic Survey of the Post as well as the Testing of a Portable Traffic Signal.

Upon his return to the Bureau of Street Traffic from the Military Service in the fall of 1952, Humphrey worked in the Engineering Division under Albert L. Forde.

During the academic year of 1954-1955, he attended the Bureau of High-

(Continued on page 513)

Siegel Appointed Indianapolis Traffic Engineer

Stanley T. "Ted" Siegel (Assoc. Mem., ITE) was recently appointed City Traffic Engineer for the City of Indianapolis, Indiana. He replaced Mr. William H. Bilby, who resigned to accept a position as Engineer of Traffic with the Indiana State Highway Department.

In his new duties, Mr. Siegel will head up the Bureau of Traffic Engineering under the Board of Public Safety Commissioners. More than fifty employees in this organization are responsible for the installation and maintenance of traffic control devices and other traffic engineering functions in this city of approximately 500,000 population.

H. Dale Humphrey and S. T. Siegel

Siegel received his degree in Civil Engineering from Tufts College in 1944 and shortly thereafter was commissioned in the Civil Engineer Corps of the U. S. Navy. Following separation from the Navy, Siegel enrolled as a graduate student at the Yale Bureau of Highway Traffic, receiving a Certificate of Highway Traffic on completion of the nine month course. His first job in the Traffic Engineering field was with the New Jersey Motor Vehicle Department as an Associate Traffic Engineer. During the three years in this capacity, he engaged in a great variety of traffic engineering activities, including services in a consulting capacity to small communities as a representative of the State.

Late in the summer of 1950, Mr. Siegel moved to Chicago as a traffic engineer in the Bureau of Street Traffic of the City of Chicago. Assigned to the traffic signal division, he also worked at many temporary assignments including direction of sign and paint crews, setting up and supervising detours, and installation of parking meters.

Siegel next joined the staff of the National Safety Council to take over the job of Secretary of the Council's Committee on Winter Driving Hazards. In addition, Siegel served as Secretary of the Congress Program Committee of the Traffic Section and represented the Council on several national committees.

Mr. Siegel has been active in ITE affairs, both locally and nationally. He is Editor of the Technical Notebook and a member of the ITE Technical Council. A registered Professional Engineer, Siegel is also active in several other engineering organizations.

McMONAGLE

(Continued from page 509)

partment, McMonagle served as an engineer on the staff of the U. S. Public Health department, and as project engineer for the St. Clair County Road commission.

He has appeared as guest lecturer at Northwestern University, Yale, University of Michigan, University of Detroit and at Michigan State University.

McMonagle was graduated with a Bachelor of Science degree in Civil Engineering from the University of Michigan, is a resident of East Lansing, married and the father of two children.

The M.S.U. Highway Traffic Safety Center represents the first university-wide attack on the traffic problem. Every department with activities relating to any phase of the complex traffic picture will be brought into service. It is the function of the center to coordinate and focus this wealth of ability upon the problems of greater highway safety and better traffic administration.

The Center will direct its efforts in five fields. The Center will expand its college courses to train personnel, will expand its calendar of conferences and workshops to help those already in the field of work, will offer field services to communities, will conduct research projects and will develop an information services program.

Membership Applications

The following applications have been received since the list of applicants in the June issue.

APPLICATIONS FOR TRANSFER

ADDISON, Walter J.
Associate Traffic Engineer
Wilbur Smith & Associates
265 Church Street
New Haven, Connecticut
May 15, 1956 for ASSOCIATE grade

BARNETT, Norman C.
Traffic Engineer
City of Tulsa
Traffic Engineering Department
Room 411, Municipal Building
Tulsa, Oklahoma
May 14, 1956 for ASSOCIATE grade

CAMPBELL, Robert Bennett
Traffic Research Engineer
Planning Division
Ontario Department of Highways
Parliament Buildings
Toronto, Canada
June 12, 1956 for ASSOCIATE grade

COYLE, Lewis R.
Traffic Planning Engineer
Department of Traffic Engineering
413 St. Paul Place
Baltimore 2, Maryland
June 28, 1956 for ASSOCIATE grade

JOHNSON, Paul Robert
Senior Civil Engineer
Division of Engineering
Department of Public Works
City Hall
Pueblo, Colorado
May 21, 1956 for ASSOCIATE grade

KANZ, Anthony Clifford
Traffic Planning Engineer
Bureau of Traffic Engineering
Department of Streets
Philadelphia, Pennsylvania
July 2, 1956 for ASSOCIATE grade

KUEHL, Roger Ernest
Assistant City Traffic Engineer
414 East 12th Street, City Hall
Kansas City, Missouri
June 7, 1956 for ASSOCIATE grade

NADON, Joseph Donald, Jr.
City Traffic Engineer
212 North Kansas Street
El Paso, Texas
May 20, 1956 for ASSOCIATE grade

WELTY, William Robertson
Senior Traffic Engineer
Texas Highway Department
Texas Highway Building
Austin 1, Texas
May 14, 1956 for MEMBER grade

NEW APPLICATIONS

BEAUREGARD, Yves H.
Assistant Traffic Engineer
Province of Quebec Roads Department
60 Street James Ouest, Room 400
Montreal, Canada
June 26, 1956 for JUNIOR grade

BILLION, Charles Edward
Principal Civil Engineer
Highway Planning
10th Floor, S.O.B.
Albany, New York
June 23, 1956 for MEMBER grade

COLPITTS, Joseph Robert
Assistant Traffic Engineer
Department of Public Works
Room 502, City Hall
Tacoma, Washington
June 4, 1956 for JUNIOR grade

HARDING, John Henry
Senior Traffic Engineer
B.C. Department of Highways
Parliament Buildings
Victoria, B.C., Canada
June 28, 1956 for MEMBER grade

KASK, Mart
Junior Engineer
Washington State Department of Hwys.
Highway Planning Division
Transportation Building
Olympia, Washington
June 1, 1956 for JUNIOR grade

LABIOSA, Victor M.
Assistant Chief of Division
Highway Planning & Research Division
Bureau of Traffic
Department of Public Works
Santurce, Puerto Rico
June 1, 1956 for ASSOCIATE grade

LEIS, Leonard Emil
Traffic Engineering Associate
Traffic Engineering Division
2nd & Oswald Streets
Toledo 5, Ohio
May 21, 1956 for JUNIOR grade

McKENZIE, Dee Willis
Consulting Traffic Engineer
1243 Marian Way
Sacramento, California
May 28, 1956 for ASSOCIATE grade

MELENDEZ, Juan F. Vives
Chief, Planning & Programming Section
Bureau of Traffic
Department of Public Works
Stop 23
Santurce, Puerto Rico
June 7, 1956 for ASSOCIATE grade

NEGRONI-VIVALDI, Rafael
Civil Engineer
Traffic Bureau
Department of Public Works
Santurce, Puerto Rico
May 15, 1956 for JUNIOR grade

NEWMAN, Dennis George
Assistant Engineer
City of Vancouver
Engineers Department, City Hall
Vancouver 10, B.C.
March 22, 1956 for ASSOCIATE grade

O'BRIEN, Shamus
Director of Traffic-Safety Division
Maricopa County Highway Department
4701 East Washington Street
Phoenix, Arizona
May 4, 1956 for MEMBER grade

PERKINS, Hubert Kirk, Jr.
City Traffic Engineer
Bureau of Traffic Engineering
900 East Broad Street
Richmond, Virginia
June 29, 1956 for ASSOCIATE grade

PETERSON, Robert George
Assistant Traffic Engineer
Bureau of Traffic
274 City Hall
St. Paul 2, Minnesota
June 18, 1956 for JUNIOR grade

RENNIE, Thomas John
Street Planning & Design Engineer
Room 809, City Hall
New Orleans 12, Louisiana
June 25, 1956 for ASSOCIATE grade

SCRUGGS, John Marshall
Traffic Engineer 1
Room 1002, City Hall Annex
Philadelphia 7, Pennsylvania
June 12, 1956 for JUNIOR grade

TAMIR, Max M.
Assistant Civil Engineer
Department of Traffic
100 Gold Street
New York 38, New York
December 22, 1955 for ASSOCIATE grade

THOLBORN, George Franklin
Assistant District Traffic Engineer
Department of Public Works
Division of Highways, District X
1976 East Charter Way
Stockton, California
May 17, 1956 for ASSOCIATE grade

VENABLE, Clinton Arthur
E.I.T. Traffic Design
Indiana State Highway Department
Bureau of Traffic
102 North Senate
Indianapolis, Indiana
June 12, 1956 for JUNIOR grade

LOOKING AHEAD

SEPT. 17-19—MACKINAC ISLAND, MICHIGAN
4th National Highway Conference of County Engineers and Officials, American Road Builders' Association, Grand Hotel.

SEPT. 17-20—ST. LOUIS, MISSOURI
Annual Meeting, American Transit Association, Jefferson Hotel.

SEPT. 17-20—DENVER, COLORADO
61st Annual Convention of the International Municipal Signal Association, Cosmopolitan Hotel.

SEPT. 24-28—SAN FRANCISCO, CALIF.
Annual Meeting of the Institute of Traffic Engineers, Mark Hopkins Hotel.

SEPT. 30-OCT. 2—DENVER, COLORADO
Fall Convention and Co-Exhibit of the American Congress on Surveying and Mapping and American Society of Photogrammetry, Shirley-Savoy Hotel.

OCT. 2-5—COLUMBUS, OHIO
Annual Short Course on Roadside Development, Ohio Department of Highways.

OCT. 2-5—QUEBEC, P.Q., CANADA
37th Annual Convention of Canadian Good Roads Association, Chateau Frontenac Hotel.

OCT. 15-19—PITTSBURGH, PENNSYLVANIA
American Society of Civil Engineers, William Penn Hotel.

OCT. 22-24—NEW YORK, N. Y.
38th Annual Meeting American Standards Association (in conjunction with Seventh National Conference on Standards), Hotel Roosevelt.

NEW! ADJUSTABLE TRAFFIC SIGN

Open *Closed*

This ingenious traffic control sign designed by Henry A. Barnes, Traffic Engineer, Baltimore, Md., can be easily adjusted for changing conditions.

It is made of 14-gauge aluminum; all screws and nuts are brass or aluminum.

Two colors with letters. Customer choice of colors.

Effective for stadiums, funeral homes, special events.

MANUFACTURED BY

WOLFE AND MANN MFG. CO.

28TH and SISSON STREETS **BALTIMORE 11, MARYLAND**

Institute Affairs

"Traffic Engineers Day"

A Proclamation

FRIDAY, JUNE 22, 1956

BY THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA

WHEREAS, with the expansion of traffic has developed the need for the greater application of the engineering science; and

WHEREAS, The Institute of Traffic Engineers, founded in 1930, has grown to a membership of one thousand; and

WHEREAS, the responsibilities of the Traffic Engineer, in addition to the gathering of data pertaining to streets, highways, parking and transit, includes planning and design of such thoroughfares as well as the development of control devices and measures required for the regulation, warning and guidance of drivers and pedestrians; and

WHEREAS, The Institute of Traffic Engineers is establishing its National Headquarters in the Nation's Capital:

NOW, THEREFORE, WE, THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA, do hereby proclaim Friday, June 22, 1956 as "TRAFFIC ENGINEERS DAY," and call to the attention of the citizens of the District of Columbia the importance of the work of the Traffic Engineer to every person who enters upon the public ways—by private motor vehicle, mass transit, truck or afoot.

ROBERT E. MCLAUGHLIN
DAVID B. KARRICK
THOMAS A. LANE
Commissioners of the District of Columbia
JUNE 19, 1956

Open House at National Office

On June 22, the new national office was formally opened with the aid of local officials, ITE members from the Washington area (and a few from more distant points) and friends. About 125 people attended the "open house" which began at 3 p.m. and ended at 9 o'clock.

The day was highlighted for Institute members by the issuance of a proclamation by the Commissioners of the District of Columbia naming June 22, 1956 as "Traffic Engineers Day." The proclamation, which was formally presented by Commissioner McLaughlin to President Prisk, is reproduced in full on this page. Representing the Commissioners at the open house was Lt. Col. T. B. Hunter, Assistant Engineer-Commissioner.

The formality of the occasion was symbolized by the cutting of a blue and gold ribbon held across the entrance door to the office. President Prisk wielded the shears with help from Colonel Hunter.

Although most of the guests were from the Washington area, several came from Baltimore, including our photographer, Charlie Upham. Other members from out of town included Bob Holmes (Huntingdon, Pa.), Guy Kelcey (Westfield, N. J.), Tom Fratar (N. Y.), Ken Hoover (Sutton, Mass.), Tom Seburn (New Haven, Conn.), Gene Simm (Harrisburg, Pa.).

Other out of town guests were: Roy B. Hindle, Union of South Africa; Ralph Moyer, University of California; Jack Prince, Interstate Printing Corp., and L. E. Gregg, University of Kentucky.

TE Award Judges Appointed

Following the decision of the Board of Direction to make awards to cities and states for traffic engineering achievement during 1955, a Board of Judges has been appointed by President Prisk. The following constitute the Board, which met July 12 in Washington:

Fred Burggraf, Director, Highway Research Board.

E. H. Holmes, Deputy Commissioner, U. S. Bureau of Public Roads.

A. E. Johnson, Executive Secretary, AASHO.

M. A. Kraft, Dir. of Personnel & Acc. Prevention, American Transit Assn.

Burton W. Marsh, Dir., Traffic Engineering & Safety Dept., American Automobile Assn.

D. Grant Mickle, Director, Traffic Engineering Division, Automotive Safety Foundation.

Harry Porter, Jr., Director, Traffic Inventory Division, National Safety Council.

Winning cities and states are listed in the news story in this issue.

Institute Listed by City Managers Association

A new report just issued by the International City Managers Association, "MIS Report No. 149—Professional Organizations of Municipal Officials," contains a description of the Institute, its objectives, membership, and services. The report endeavors to stimulate city officials to seek professional help and to recognize the professional organizations such as the Institute. Perhaps the complete survey would be of interest to you and your colleagues.

New Reports of Interest

Many reports of various kinds flow into the national office. An attempt will be made to list those considered to be of general interest—with the ultimate objective of a section of the magazine in which all new publications can be reviewed. As a beginning, however, only the most important will be listed here.

"Relative Hazards at Railroad Grade Crossings on State and Federal-Aid Highway Systems," Technical Report No. 56-3, Oregon State Highway Dept., Salem, Ore., 109 pp., April, 1956. $2.00

"What Should the Maximum Speed Limit Be?" Chicago Motor Club, Chicago, Ill., 13 pp. (mimeo.), June, 1956

"What Parking Means to Business," Automotive Safety Foundation, Washington, D.C., 55 pp., Nov. 1955, free

"How to Get the Most Out of Our Streets," Chamber of Commerce of the U.S., Washington, D.C., 52 pp. (no date), $1.00

Ribbon cutting with help from Lt.-Col. T. B. Hunter, Assistant Engineer-Commissioner of the District of Columbia.

President Prisk greets Paul F. Royster, Assistant to the Undersecretary for Transportation, U. S. Department of Commerce.

FEDERAL-AID HIGHWAY

(Continued from page 507)

the amounts that will be available in the Trust Fund to defray expenditures. In any case where the available amounts would be insufficient to defray expenditures as a result of apportionments, he shall advise the Secretary of Commerce who shall reduce the apportionments by a percentage that will allow the apportionments to be covered by amounts in the Trust Fund. Any funds withheld may be apportioned at any subsequent time that amounts are available in the Trust Fund and such funds shall remain available for expenditure until the close of the third fiscal year following that in which apportioned.

Study of Equitable Tax Allocation—The law directs the Secretary of Commerce in cooperation with other Federal agencies and the state highway departments to study and investigate:

(1) The effects on the design, construction and maintenance of Federal-aid highways of the use of vehicles of different dimensions, weights and other specifications, and the frequency of occurrences of such vehicles in the traffic stream;

(2) The proportionate share of costs attributable to each class of persons using such highways, and

(3) Any direct and indirect benefits accruing to any class which derives benefits from Federal-aid highways, in addition to benefits from actual use of such highways which are attributable to public expenditures for such highways.

The Secretary would be required to make the final report as soon as possible but not later than March 1, 1959. Interim progress reports would be required on March 1, 1957 and March 1, 1958.

—Digested by

NATIONAL HIGHWAY USERS CONFERENCE

H. DALE HUMPHREY

(Continued from page 509)

way Traffic at Yale University and upon completion of the course of study, returned to the Traffic Control Signal Division of the Bureau of Street Traffic and Parking in Chicago.

Humphrey is a registered Professional Engineer.

Section News

WESTERN SECTION

Snipped from Western ITE Newsletter

Oregon Area

The Ninth Northwest Traffic Engineering Conference went off without a hitch. As expected, Oregon won the Golf Tournament which was played in ideal weather on the beautiful Corvallis Country Club Course in the foothills just outside Corvallis. *Bergstrom, Nelson, Conklin,* and *Henberger* split the prize money. *Skinny DeYoung* the perennial champion of the tennis court couldn't find anyone willing to challenge him, although several disgruntled golfers were heard to remark that they were going to take up some other sport—maybe tennis.

Val Johnson has gone for an extended vacation in the Midwest, his first time away from the job in many years. He left *Glen Clark* chained to a desk with instructions to have the proceedings ready for publication when he gets back about the middle of June.

"Ladies Night" plans are now complete and the committee is looking forward to a very successful meeting.

Bob Blensly and *Dave Schoppert* are burning the midnight oil drawing plans for relocation of the electronic scale. It will be moved to the Portland-Salem Freeway.

Bob Conklin has both feet firmly planted in the air these days, ever since he got word that he had passed the exam for registration.

The Oregon Area has another potential member—*Lawrence William George,* born on April 27, 1956. He weighed in at 7 pounds and 12 ounces. *Bud* and *Lois* are allegedly grooming him for section prexy in 1986. The *Georges* are also the proud possessors of a new home on Candalaria Heights. If *Bud* looks a little befuddled these days, think nothing of it, fatherhood and mortgagehood all at the same time can be very trying.

Ever since the opening day of trout season, fish stories have been a dime a dozen, but we like this one. *Bob Blensly* spent last weekend fishing on the little North Fork. Saturday he took *Steve* his five year old son. Sunday he took *Steve* and *Connie* — total catch for the weekend one twelve inch rainbow hooked and landed by guess who, *Steve*!!!!!! Oh well, you can't be a hero all the time.

Bruce Crandall and *Bob Dunn* squared off at the Fifth Regional Traffic Court Conference sponsored by the University of Oregon Law School in Eugene. The bone of contention—Prima Facie versus Absolute Speed Law. The Judges decision — a draw.

Al Head, who won fame and fortune with the Portland Freeway Plan is not content to rest on his laurels. He is now working with local governments through their Planning Commissions to push acceptance of an over-all plan by all agencies concerned. Once that is done, the skids will be greased for construction of the sorely needed Freeway and Expressway Network.

San Diego Area

Jim Reading and his staff have moved into new quarters in Civic Center. These large and spacious quarters, entered through Room 259, Civic Center, are referred to by some as the "Black Hole of Calcutta."

Except for the problem of photographic reproduction we would be able to include with this news item a very complimentary photo of a 36 pound yellowtail holding up *Lucky Luckenbach.* We understand the fish believed that *Lucky* was using unfair tactics in this $2,500 contest.

The April meeting of the Los Angeles Section saw San Diego represented by *Jack* and *Helen Henberger, Marty* and *Jen Bouman,* and *Paul* and *Janice Fowler.* A good time was had by all.

John Tsiknas spent two weeks straightening out the Transportation Section of the Eleventh Naval District.

The San Diego Section was most pleased to hear that *Chuck Strong* received a Yale ASF Fellowship for next year. Good luck to *Chuck* and *Leason.*

The California Division of Highways recently opened a 2 mile section of full freeway on State Highway 94.

Keith Gilbert reports that the machine processing of the traffic assignment program of the Transportation Study is proceeding rapidly and that the last step prior to obtaining volumes on all sections of the major street and highway and freeway system, as well as turning movements on the freeways, is underway. *Keith* is also finishing up an interesting series of desire line charts with various volume ranges of desire lines shown on several overlays.

Steve George of the Transportation Research Staff of the City of San Diego is about to take that big step with a very lovely young lady. Best wishes *Steve.*

Ed Hall reports that the programmed schedule for the San Diego Metropolitan Area Transportation Study and the Pilot City projects is all wrapped up for fiscal year 1956-57. Thirteen departments and divisions of the City and the San Diego Transit System are actively participating in this study with technical cooperation from

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the County, Division of Highways and the five other cities of the metropolitan area.

Paul Fowler reports that the proceedings for the 1955 Annual Meeting of the Western Section of the ITE are now ready to go to press.

A Pre-Nuptial Massacre was held for *Stephen George* in the San Diego Hotel on Thursday, May 31. The WesternITErs participating in this grand sendoff with the proper indoctrination and remarks for the education of *Steve* were *Jim Reading, Marty Bouman, Paul Fowler, Hal Durham, Keith Gilbert, Ed Hall, Don Robbins, Chuck Strong* and *John McDonald.* This very orderly crew then proceeded to the Hollywood Thespian Theater where they were very shocked by the performance and by *Steve's* intimate acquaintanceship with the members of the cast.

On May 8 and 9 Co.vallis, Oregon, was the scene of the Northwest Traffic Engineering Conference. ITE members from the State of Washington in attendance were *Squeegee Glaze, Rex Still, Jim Gallagher, Bill Kingman, Dave Swanson, "Lew" Lewarch, Bruce Culver, Bob Warr* and *Yosh Kosai. Still* presided over one of the panel discussions on "What's New in the Northwest." Also in attendance was our Assistant Director, *O. R. Dinsmore,* who appeared on a panel on "Urban Freeway Programming and Development" with *Earl Miller* of Idaho and *W. C. Williams* from Oregon.

May 24 was the last day of work in the Washington Department of Highways for *Richard Long,* Senior Traffic Engineer, working for *Rex Still. Dick* has accepted a position with *Wilbur Smith* and Associates in New Haven, Conn., and left Olympia via automobile with his family for the long trek eastward on May 26. *Dick* reports for work on June 15. En-route the *Longs* will visit their parents in Chicago and St. Louis.

On May 17 before *Dick* could slip from our grasp, the Washington Area held a combined Area meeting and *Dick Long* farewell party at the Olympia Golf and Country Club. A delicious family - style chicken dinner was enjoyed by the following: *Herb Higgins, Rex Still, Squeegee Glaze, Elmer Clees, Bob Dunn, John Mladinov, Bob Hansen, Bob Curry, "Lew" Lewarch, Bruce Culver, Roy Sawhill, Yosh Kosai* and the honored guest, all ITE'rs, and the following departmental associates and friends of *Dick; Val Rinehart, Bill Jayne* and *Huntley Grant* of the Division of Plans and Contracts; *Joe Thornton,* Engineer of Limited Access from the Seattle District Office; *Gene Ireland* and *Al Salberg,* part of *Rex's* gang; *Carroll Sloan* of the Motor Vehicle Permit Division; *George Van Meighem* of the Planning Division, *Don Larson,* MMM; *Leo Proby,* Eagle Signal, and *Guy Beyersdorf, Charles R. Watts* and Company. *Dick* was presented with a brief case by the gang present and he assured us it would be kept well filled in his new job. A scroll bearing the names of all those present, plus those of the Director and his two principal assistants, was presented to *Dick* so that he wouldn't forget who his former associates were.

During the meeting *Herb Higgins* requested of the members any items which they might like presented at the Board Meeting in Denver. Several items were discussed and *Herb,* we are sure, left the meeting with sufficient information to take up considerable time in the Board Meeting.

The 1955 Annual Traffic Report of the State of Washington was recently published under the direction of *E. A. Clees* and *R. J. Hansen.* The report was prepared using business accounting machine techniques, and has received quite considerable acclaim from the recipients of the report.

In between the planning and scheduling of O-D surveys for this summer and completing route analyses and economic studies, *J. K. Mladinov* and *R. J. Hansen* have set up a program of accident rate calculations on business accounting machines. The report when published will be the most thorough of its kind prepared in the State of Washington. *Hansen,* in addition, is assisting the Department of Highways, Division of Plans and Contracts, in setting up a high speed electronic computor program for Earthwork Computations.

Yosh Kosai has just recently completed his annual cordon counts of the CBD in Tacoma. These have proven to be very valuable to *Yosh* in satisfying the people to whom he is responsible, as well as supplying valuable information to the State and other city agencies.

MICHIGAN SECTION

The Annual meeting of the Michigan Section was held on June 6 at the Selfridge Air Force Base. President *Gervais* called the meeting to order at 7:35 p.m. Minutes of the previous meeting were read and approved. Program chairman *Sam Levine* introduced the hosts—*Major Gurman* and *Major Dodson.*

Old Business

Al Malo reported that 1957 convention in Detroit had the approval of the ITE Board of Directors who met in Denver and set the week of September 23rd, 1957, as the date.. As previously announced the Statler Hotel will be headquarters hotel. *Al* reported that convention committee assignments would be made soon.

Harold Bauerle, chairman of the Membership Committee, reported there were 55 regular members. He stated that the proportion of affiliates was a little too high but that several affiliate members should be regular members. It was recommended that the new president take steps to see that these prospects get application blanks. A review of the by-laws to more adequately cover other interested persons other than members and affiliates was suggested. Also, it was brought out that the organization was large enough now to consider the possibility of appointing a board of directors.

Secretary Hayes introduced *Roscoe Hefron,* Michigan State Highway Department, a new member of ITE and *Robert Larson,* Oakland County, a new junior member of ITE. He reported that *James Loughran,* an ITE associate member, Highway Engineer, Federal Civil Defense Administration, was in Battle Creek and was interested in Michigan Section activities.

President Gervais decided to get rid of his burden so he announced that election of officers would be held.

Al Malo was nominated for president and nominations were closed. The secretary was instructed to cast a unanimous ballot for *Al Malo.* Carried.

Al Hayes was nominated for vice president and nominations were closed. The secretary was instructed to cast a unanimous ballot for *Al Hayes.* Carried.

Bill Marvin and *Oscar Gunderson* were nominated for the secretary-treasurer post. Tellers *Toth* and *Vanderstemple* passed out ballots and tabulated the results, which gave *Bill Marvin* a majority of the votes.

As many non-voting affiliates had strayed away from the meeting *Roscoe Hefron* was hastily appointed sargeant-at-arms to get them back.

Ex-president *Gervais* turned the meeting over to President *Malo.*

President *Malo* promised action on the suggestions of the Membership Committee in regard to members, by-laws and board of directors.

New Business

Program Chairman *Levine* introduced *Major Dodson,* Provost Marshall, Selfridge Air Force Base, who expressed regrets for Colonel *Richard Winter,* Commanding Officer, who was unable to be present.

Major *Dodson* pointed out that the 3 Es play an important part in the operation of the Base. Vehicle registration and operation are strictly controlled. All vehicles must have PD & PI insurance; must be able to pass Base safety inspection program; and are subject to all rules and regulations on the Base which are enforced by the Air Police. First offenses carry a warning, second offenses result in suspension of driving privileges for two weeks, and serious offenses are dealt with according to the nature of the offense.

He pointed out that there was a serious shortage of parking space on the Base, that many signs were to be replaced with emphasis being placed on Yield Right of Way signs instead of Stops signs to help expedite the flow of traffic on the Base.

"Informers" giving violation information to authorities plays an important part in effective enforcement.

In answer to a question about special equipment operation on the Base, the Major pointed out that special schooling and examinations are given to personnel before they are allowed to operate this equipment.

(Continued on page 518)

Miscellanea

SAN DIEGO—THE PILOT CITY FOR NATIONAL COMMITTEE ON URBAN TRANSPORTATION

By Edward M. Hall

Scope of the Manual

The National Committee on Urban Transportation believes that urban transportation planning must be conducted along nine distinct lines of attack. The Manual includes these nine areas grouped under two general purposes:

Factual Inventory and Data Gathering

1. Administration
2. Laws
3. Financial records and reports
4. Travel desires
5. Measurement of existing street services
6. Inventory of existing street facilities
7. Measurement of existing transit service

Analysis, Interpretation and Application of Factual Information

8. Recommended standards for street service and facilities
9. Recommended standards and objectives for transit service.

San Diego Organization

The pilot city program of the City of San Diego is a part of the San Diego Metropolitan Area Transportation Study. The pilot city program as well as the transportation study is directed by the Transportation Research Division which has been in existance since March of 1955. To utilize properly the data assembled through the pilot city program and to develop integrated urban transportation planning an Advance Transportation Planning Team has been organized. This team is composed of a Planning, Traffic Engineering and Highway Design representative who work together in one room on advance transportation planning.

The San Diego Metropolitan Area Transportation Study has been based on the concept that transportation is a metropolitan area problem and must be studied as such. To coordinate this metropolitan area study a Technical Coordinating Committee has been organized and is composed of the planning directors, city engineers and traffic engineers of the six cities, the county, and the California Division of Highways. In addition it has representatives of the transit company and the U. S. Navy. This Technical Coordinating Committee also serves to interchange information and thus many of the benefits of the Pilot City Study of the City of San Diego can be passed on to the other jurisdictions of the Metropolitan Area.

Summary

Both the Transportation Study and the Pilot City program are a part of the intent and effort of the City of San Diego to provide its citizens with the safe, convenient and economical transportation service they desire.

Sam Levine was commended for his splendid handling of the years' programs. The Air Force authorities were complimented and thanked for an interesting and informative visit at Selfridge.

Al Malo introduced *Hayes* and *Marvin* and the meeting adjourned with, we are sure, a better understanding of what the Armed Forces are doing to protect us.

About 60 members and guests attended this meeting. Meeting adjourned 8:40 p.m.

ALLEN T. HAYES
(Ex) Secretary-Treasurer

Introduction

Transportation is of vital importance to each of us in our everyday life and to the economy and standard of living we enjoy. Transportation means various things to various people. It may mean waiting for the signal light to turn green. It may mean waiting for the bus three blocks away from home and wishing the scheduling was improved. It may mean looking for a parking space downtown. It may mean waiting for the goods which were shipped by truck and which have not yet arrived. It can even mean being jostled on a crowded sidewalk. Broadly it means the movement of people and goods.

In San Diego, a rapidly growing metropolitan area has experienced many problems one of which surely is the traffic and transportation problem. Perhaps this problem is best emphasized by the traffic volume growth on Mission Valley Road between Ward Road and Fairmount Avenue. The volume in 1952 was approximately 20,000, in 1955 it had exploded to over 40,000 vehicles per day.

Nationally as well as locally the problems of urban transportation have been rapidly increasing during the past few years and it is expected that by 1975 the number of motor vehicles on our streets and highways will be approximately double what they are today. Obviously this could mean a longer wait for the green light, more delay to transit, approximately half as many parking places, probably more delay while waiting for the goods that are shipped by truck and perhaps more pedestrians.

The National Committee

In an effort to combat this serious problem the National Committee on Urban Transportation was founded in May of 1954. The National Committee on Urban Transportation is composed of representatives of the following organizations:

American Municipal Association
American Public Works Association
American Society of Planning Officials
International City Managers' Association
Municipal Finance Officers Association
National Institute of Municipal Law Officers
U. S. Bureau of Public Roads
Highway Officials
Canadian Cities

Since its founding the National Committee and its nine sub-committees have been developing a Manual of methods and procedures whereby cities can collect basic facts and information to evaluate their transportation system in terms of existing and potential needs. These methods and procedures are designed to assist cities, large and small, in assembling, evaluating, and utilizing facts in an economical and efficient manner with their own personnel and within the normal framework of municipal administration. The uniform data gathering and procedures should produce much helpful information that can be exchanged throughout the country.

Pilot Cities

This Manual is now complete in draft form. To test the methods and procedures under field conditions the following pilot cities were selected in March 1956:

City	1950 Population
Detroit, Michigan	1,849,568
San Diego, California	334,576
Syracuse, New York	220,583
Phoenix, Arizona	106,818
Albuquerque, New Mexico	96,815
Oak Park, Illinois	63,529
Crawfordsville, Indiana	12,851

Cities and transit companies participating in the pilot city program will receive a number of benefits. These include:

1. The aid and counsel of experts having developed the various studies to be carried out.
2. The advantage of factual knowledge concerning their specific problems.
3. The benefit of the additional experience gained by the personnel involved.

San Diego Benefits

The information obtained by San Diego through the pilot city program, when measured against the yardstick provided by the National Committee Manual, will make it possible to:

1. Determine urban transportation deficiencies.
2. Evaluate the soundness of existing transportation policies and practices.
3. Provide for proper consideration and integration of all forms of transportation.
4. Develop realistic plans and programs to improve the transportation service in San Diego.

(Continued on page 518)

Strictly Business

Reflective Sign Finish Introduced by Prismo

A new sign finish, developed in the Prismo Research Laboratories, has been put on the market. It is Prismo 200 Hi-Reflective Finish, and is extremely versatile in application, use and effect, according to the manufacturer. It can be easily applied by brush, roller, silk screen, coater or any type of spray directly on the sign blank. Any shape, size or surface that can be painted can be reflectorized with Prismo '200', which gives a uniform coating to porous and non-porous surfaces alike. It becomes an integral part of the sign and thereby provides long wear life.

Designed for use on warning, regulatory and guide signs, Prismo '200' is effective in daylight, and has long range "punch" at night. Signs coated with Prismo '200' have complete wide-angle reflection and are free from metallic glare. The sign finish combines intense reflectivity with non-glare legibility.

An exclusive feature of Prismo '200' is the built-in "Moisture-Pruf" ingredient that repels water so the signs have hi-target flash in bad weather conditions. This special chemical treatment also adds greatly to the wear-life of the signs. Another feature of Prismo '200' is its economy. There is no waste because only the amount needed for the job is used. All the material goes on the sign, eliminating loss in trimming. The manufacturer reports that many sign shops can reduce their reflectorizing costs more than 50% by adopting Prismo '200'. Complete information is available. Write for Prismo Bulletin No. 256, Prismo Safety Corporation, Huntingdon, Penna.

Businessmen's Assn. Uses LUXaire Luminaires

The "14th Street Businessmen's Association" converted 14th Street between Union Square and 6th Avenue into the most intensely illuminated thoroughfare in New York City. The White Way features the use of 22 "V" shaped 8'

LUXaire fluorescent luminaires mounted on aluminum poles. These luminaires have a 30 ft. mounting height and are on 25 degree elevation with a 25 degree lateral adjustment. Each complete unit has two LUXaires and four 8 ft. rapid start lamps F96T12/CW/RSR. Each lamp has a life expectancy of 7,500 hours and should burn for at least two years under the worst conditions. The average foot candles for the installation is better than 2 and this soft glarefree type light is so abundant that the above photo was taken at 1/10 of a second stopping vehicular as well as pedestrian traffic.

The installation was sponsored by the "14th Street Association," approved by the Department of Gas and Water Supply of the City of New York, installed by Broadway Maintenance, and LUXaires and poles supplied by Pfaff & Kendall of Newark, New Jersey.

Portable Photocopy Unit Available

A compact, lightweight portable unit which exposes clear, permanent copies of almost any type of written or printed material has been announced by the Copease Corporation here, according to C. E. Hallenborg, president. This new addition to the Copease line fits into a briefcase and can easily be carried on

(Continued on page 518)

Perpetual School Traffic Signal

A new type of school traffic signal, called the "Perpetual Traffic Signal," is now available from the Hawkins-Hawkins Company. This signal provides a distinctive method of warning motorists of the presence of a school cross-walk. It requires little maintenance, is very durable and easy to operate.

The unit features a moving sign which operates by a system of counterbalances, which are activated by a small control handle. The sign will continue its pendulum action for as long as 10 minutes, but it can be stopped and returned to its housing at any time by moving the control handle.

Any type or size of sign may be used, up to and including 30 inches. No wiring or assembling is required—units are shipped ready for erection in a concrete base and immediate operation. For additional information, write: Hawkins-Hawkins Co., Inc., 1255 Eastshore Highway, Berkeley 10, California.

New Lantern for Area Illumination

A modern-day version of the old-fashioned kerosene or gasoline fueled utility lantern, but powered by a new

two-in-one dry battery yielding up to four times the life of the ordinary lantern battery, has been developed by Burgess Battery Company.

Outstanding element of its engineering and construction, setting it apart from all traditional types of liquid fuel-powered lanterns for area illumination, is its simplicity of operation and safety, according to Fred J. Kirkman, Burgess' Executive Vice President.

Complete with battery, the new lantern sells for $8.95; replacement batteries are $2.45. The light-head alone is $6.50; model TW7 is finished in chrome; TW8 comes in a copper finish to match cottage or den decor.

PHOTO COPY

(Continued from page 517)

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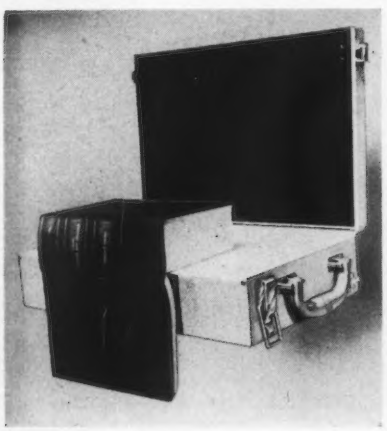

Anything written, printed, typed, drawn or photographed—from color or black-and-white originals—can be exposed by placing the original in the photocopier with a sheet of sensitized paper and simply flipping the switch. The 9½" by 14¾" copying surface comfortably copies up to legal size paper. A special storage compartment within the printer protects exposed negatives until they can be developed.

All-metal portable exposing unit weighs only 12½ pounds and operates on either alternating or direct current. $79.50 complete with separate electrical cord. For additional details, write Copease Corporation, 270 Park Avenue, New York 17, N.Y.

SECTION NEWS

(Continued from page 515)

Mr. *Ost,* Ground Safety Officer, pointed out that 85 per cent of all accidents involving Base personnel occurred off the Base and that the rate on the Base was very low with .01 accidents per 100,000 miles.

Lt. *Schaeffer* is to be commended for a good job done in the afternoon tour of the Base.

MISCELLANEA

(Continued from page 516)

5. Provide for coordinated Metropolitan Area transportation planning.
6. Present to legislative bodies and the public alike a clear picture of transportation needs based on accurate factual data.

Obituary

M. Alfred Kaehrle (Associate Member, ITE) died in Hartford, Connecticut, on July 4, 1956. He was 47 years old.

A long-time Institute member, Mr. Kaehrle was formerly Assistant Director of the Bureau of Traffic Planning and Design of the Connecticut State Highway Department. He resigned in 1954, after 22 years there, to establish his own traffic engineering consulting office in Hartford. Earlier he had worked for the Port of New York Authority on the construction of the George Washington Bridge.

While in Hartford he was for a time Vice Chairman of the West Hartford Town Planning and Zoning Commission.

He was a member of the American Society of Civil Engineers, the Connecticut Society of Civil Engineers, Sigma Xi and Tau Beta Pi.

Positions Available

CITY OF PALM SPRINGS, CALIFORNIA

Position: Engineering Assistant with traffic engineering experience.
Salary: $390-$480 per month.
Requirements: minimum of two years of college and three years of sub-professional experience.
Apply: Mr. R. W. Peterson
City Manager
Palm Springs, California

CITY OF SEATTLE, WASHINGTON

Position: Associate Traffic Engineer.
Salary: $6,300-$6,600 per year.
Requirements: Graduate engineer with four years of traffic engineering experience, one year of which may have been in graduate study in traffic engineering.
Apply: Mr. P. D. Sankey
Principal Accountant
Engineering Department
404 County-City Building
Seattle 4, Washington

CITY OF CORPUS CHRISTI, TEXAS

Position: Senior Traffic Engineer.
Salary: $487 to $562 per month.
Requirements: Graduate engineer with some traffic experience and either a registered professional engineer or eligible for registration soon.
Apply: Paul W. Rice, Director
Traffic Engineering
Corpus Christi, Texas

CITY OF RICHMOND, VIRGINIA

Position: Assistant Traffic Engineer.
Salary: $4,992 to $5,980 annually.
Requirements: Male—Age 25-45. College graduate with four years of traffic engineering experience preferably relative to urban traffic problems. Two years of such experience must have been in responsible charge.
Apply: Myrtle W. Hagood (Mrs.)
Personnel Administrator
Room 314, City Hall
Richmond, Virginia

CITY OF SAGINAW, MICH.

Position: Traffic Engineer
Salary: $7000 to $7680, depending on qualifications
Requirements: Engineering graduate with appropriate background and experience to head City's Traffic Engineering Division. Consideration will be given to a recent graduate on a trainee basis.
Apply: Personnel Department, Room 201, City Hall, Saginaw, Michigan.

ITE Sustaining Organizations

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Elastic Stop Nut Corporation of America
1027 Newark Avenue Elizabeth 3, New Jersey
Attention: Mr. Irving J. Mack
Sustaining Organization Representative

Aluminum Company of America
Alcoa Building Pittsburgh 19, Pennsylvania
Attention: Mr. M. R. Schuster
Sustaining Organization Representative

American Transit Association
292 Madison Avenue New York 17, New York
Attention: Mr. George W. Anderson
Sustaining Organization Representative

Automatic Signal Division, Eastern Industries, Inc.
Regent Street East Norwalk, Connecticut
Attention: Mr. Paul L. Green
Sustaining Organization Representative

California Metal Enameling Company
6904 East Slauson Avenue Los Angeles 22, California
Attention: Mr. Standish K. Penton
Sustaining Organization Representative

Crouse-Hinds Company
Wolf & Seventh North Street Syracuse, New York
Attention: Mr. Kenneth W. Mackall
Sustaining Organization Representative

Fiberaised Bar and Line Company
P. O. Box 268 Sausalito, California
Attention: Mr. John E. Perry
Sustaining Organization Representative

Flex-O-Lite Manufacturing Company
P. O. Box 3066 (Affton Br.) St. Louis, Missouri
Attention: Mr. Preston D. Law
Sustaining Organization Representative

General Electric Company
920 Western Avenue Lynn, Massachusetts
Attention: Mr. D. T. Carter
Sustaining Organization Representative

The Grote Manufacturing Company, Inc.
Bellevue Kentucky
Attention: Mr. W. E. Miles
Sustaining Organization Representative

Hawkins-Hawkins Company, Inc.
1255 East Shore Highway Berkeley 10, California
Attention: Mr. Norman L. Hawkins, Jr.
Sustaining Organization Representative

Hubbard and Company
6301 Butler Street Pittsburgh 1, Pennsylvania
Attention: Mr. C. C. Warne, Jr.
Sustaining Organization Representative

Lyle Signs, Inc.
2720 University Avenue, S.E. Minneapolis, Minnesota
Attention: Mr. R. H. Bjorklund
Sustaining Organization Representative

Magee-Hale Park-O-Meter Company
Commerce Exchange Building Oklahoma City 2, Oklahoma
Attention: Mr. G. A. Hale
Sustaining Organization Representative

The Marbelite Company, Inc.
27 Warren Street New York 7, New York
Attention: Mr. William E. Lenz
Sustaining Organization Representative

Minnesota Mining & Manufacturing Company
900 Fauquier Avenue St. Paul 6, Minnesota
Attention: Mr. Donald O. Opstad
Sustaining Organization Representative

Miro-Flex Company, Inc.
1824 East Second Street Wichita, Kansas
Attention: Mr. H. N. Carver
Sustaining Organization Representative

Portable Traffic Signals, Inc.
146 West 21st Street Los Angeles 7, California
Attention: Mr. W. W. Taylor
Sustaining Organization Representative

Prismo Safety Corporation
Huntingdon Pennsylvania
Attention: Mr. John C. Horn
Sustaining Organization Representative

Revere Corporation of America
Wallingford Connecticut
Attention: Mr. Walter K. Davies
Sustaining Organization Representative

Reynolds Metals Company
2500 South 3rd Street Louisville 1, Kentucky
Attention: Mr. Douglas McKellar
Sustaining Organization Representative

Robbins Tire and Rubber Company
Tuscumbia Alabama
Attention: Mr. Ellis Webb
Sustaining Organization Representative

The Streeter-Amet Company
4101 North Ravenswood Avenue Chicago 13, Illinois
Attention: Mr. George F. Graham
Sustaining Organization Representative

Traffic and Street Sign Company
84 Foundry Street Newark 5, New Jersey
Attention: Mr. Walter M. Schoenfeldt
Sustaining Organization Representative

Tuthill Spring Company
760 Polk Street Chicago 7, Illinois
Attention: Mr. H. T. Moore
Sustaining Organization Representative

Union Metal Manufacturing Company
1432 Maple Avenue, N.E. Canton 5, Ohio
Attention: Mr. W. A. Porterfield
Sustaining Organization Representative

U. S. Porcelain Enamel Company
4635 East 52nd Drive Los Angeles 22, California
Attention: Mr. J. L. Hodgkinson
Sustaining Organization Representative

Wald Industries, Inc.
301 Penn Street Huntingdon, Pennsylvania
Attention: Mr. John R. Wald, Jr.
Sustaining Organization Representative

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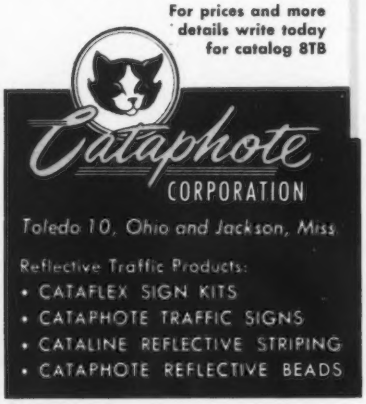

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TRAFFIC ENGINEER
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Write: Roy E. Pratt, P. E.
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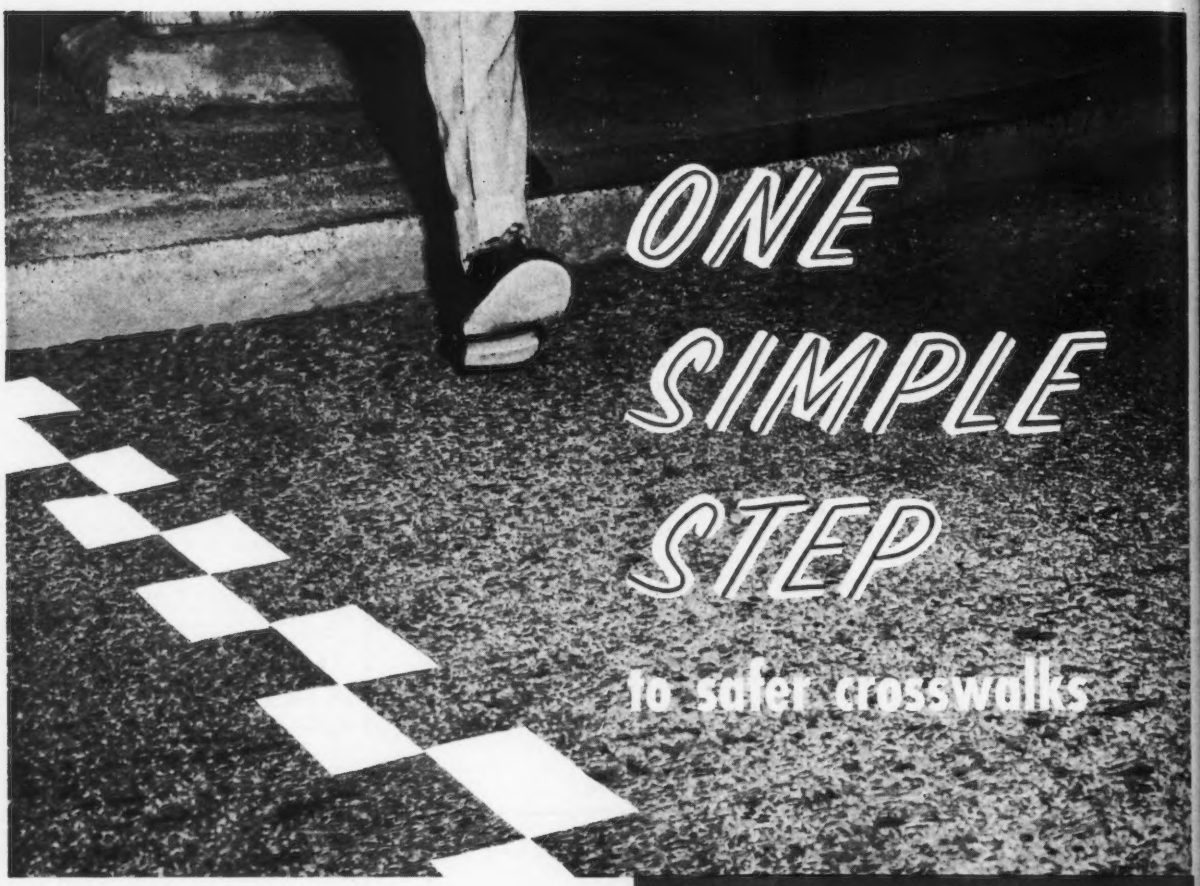

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